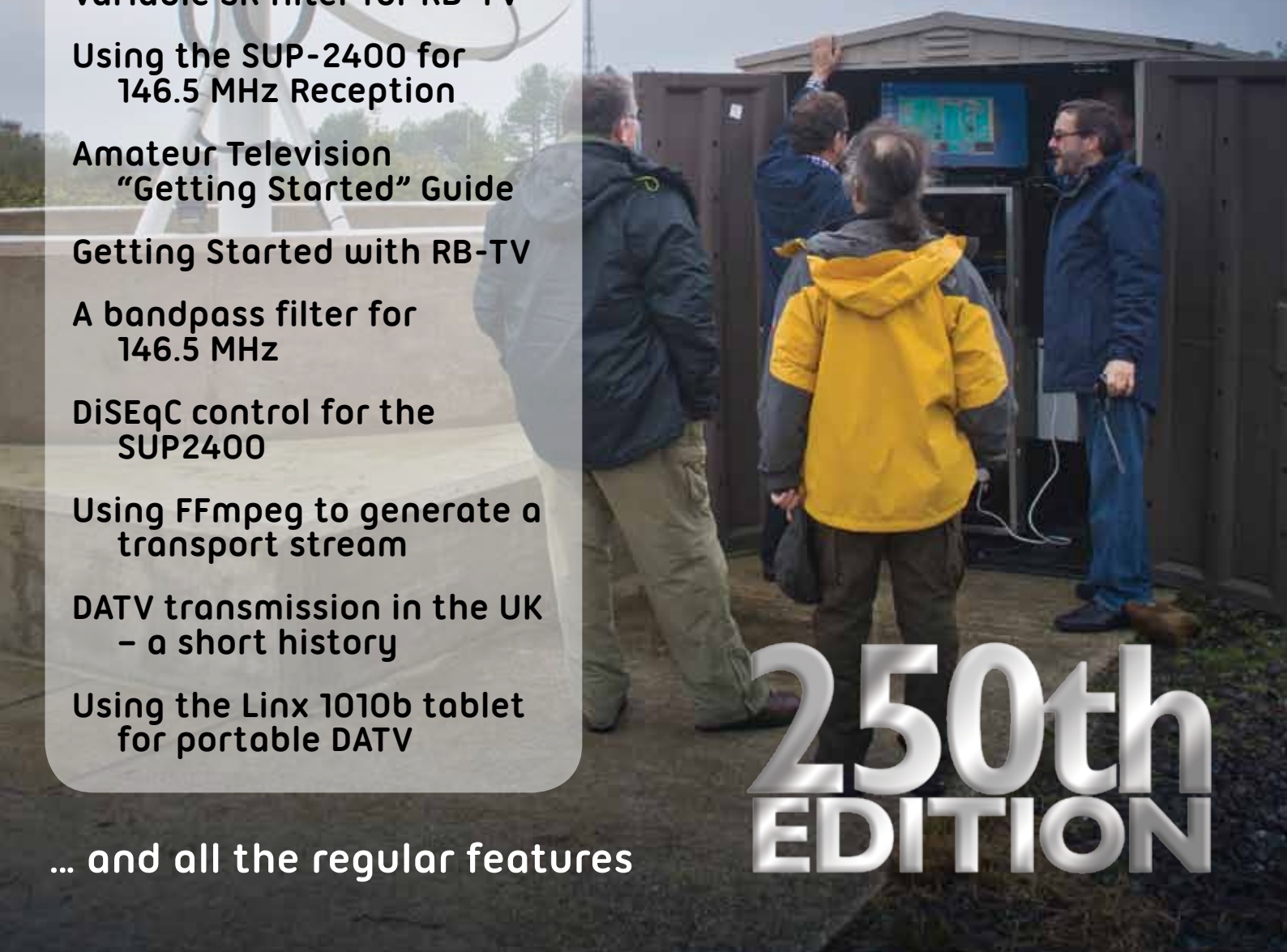
The British Amateur Television Club

CQ-TV

No. 250 – Winter 2015

HamTV to be activated early in the New Year for Tim Peake's Principia schools mission



- ARISS and HamTV
- Goonhilly Earth Station
- Variable SR filter for RB-TV
- Using the SUP-2400 for 146.5 MHz Reception
- Amateur Television "Getting Started" Guide
- Getting Started with RB-TV
- A bandpass filter for 146.5 MHz
- DiSEqC control for the SUP2400
- Using FFmpeg to generate a transport stream
- DATV transmission in the UK – a short history
- Using the Linx 1010b tablet for portable DATV

250th EDITION

... and all the regular features

BATC DTX1 Digital TV Transmitter

MPEG-2 encoder and DVB-S modulator

- Self contained unit - computer not required.
- Composite and S-video input
- 2 audio channels
- Single PCB design
- Plug in option for 2nd video & audio channels
- Size: 165mm wide; 120mm deep; 55mm high
- Tunes the 70cm and 23cm bands. Tuning range from 150Mhz - 2Ghz
- -5 dBm output
- Power 500mA at 12 volts
- LCD front panel and keypad control
- RS232 control port

Specification subject to change without notice

Available from BATC shop

- DTX1 DATV transmitter PCB complete with case and front panel
  £459 *including postage*

ATV Activity Weekend

12 - 13 March 2016

- ***Not a Contest - just a weekend of ATV Activity***
- ***All bands from 50MHz to 24 GHz***
- ***Digital and Analogue modes***
- ***Repeater and Simplex contacts***
- ***Coincides with International Activity Weekend***
- ***See the BATC Forum for more information***

Time to blow the cobwebs off all that gear and get on air!

BATC

CQ-TV 250

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Printed in Great Britain. ISSN 1466-6790

Contents:

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The preferred method of communication is by email, all email addresses are shown above.

Alternatively you can write to us at:
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We aim to publish CQ-TV quarterly in March, June, September and December.

The deadlines for each issue are:
Spring - Please submit by February 28th
Summer - Please submit by May 31st
Autumn - Please submit by August 31st
Winter - Please submit November 30th

Please send your contributions in as soon as you can prior to this date. Don't wait for the deadline if you have something to publish as the longer we have your article, the easier it is for us to prepare the page layouts. If you have pictures that you want including in your article, please send them, in the highest possible quality, as separate files. Pictures already embedded in a page are difficult to extract at high quality but if you want to demonstrate your preferred layout, a sample of your finished work with pictures in place is welcomed. Please note the implications of submitting an article which are detailed on the contents page.

From the Chairman...

Noel Matthews - G8GTZ

Firstly, all the team at BATC would like to wish you all the very best for the New Year and apologies that CQ-TV was slightly late but as you can see, this is the 250th edition and is packed with ATV related articles so I'm sure you will agree it was worth waiting for! In particular, it includes the first two articles in the ***"ATV Getting Started"*** series which will be available as separate articles and a booklet on our website. These have been written not only for your own use, but to hand around at your local radio club to introduce more people to our great hobby and we are looking for feedback and ideas on future topics to be covered.

2015 has been a good year for BATC and the ATV community – we have seen the take up of the new 146 MHz band along with the development of the RB-TV technologies, the release of yet another new band for ATV at 70 MHz, a highly successful CAT15 meeting, the introduction of activity days which will become a permanent feature in the ATV calendar, increased co-operation with other ATV organisations in Europe and our membership continues to increase and currently sits at around 950.

The BATC shop was particularly busy this year as it fulfils its role of supporting the hobby by providing those hard to get components, particularly for the RB-TV developments. However, your BATC is starting to be held back by the lack volunteers to run it and one aspect of this that we were no longer able to supply kits for the minituner hardware simply because we could not find anyone to assemble the kits.

This shortage of volunteers is starting to hit other areas and in this issue you will see adverts for a new membership secretary and also someone to undertake a short term project to create an index of recent CQ-TVs. We are also still looking for volunteers to help with the re-development of our web services, including the membership database which is starting to really show its age as many of you who have been unable to log in will know – this results in an email to committee members and we have to manually fix the problem, so please be patient if you don't always get an instant response.

So please give thought as to how you can be a part in taking your BATC forward in 2016 – if you are able to help with any of the above tasks, please contact us. If you feel unable to take on a specific task, don't forget there's the general meeting and CAT16 later this year and we will be looking for new committee members to help the club do even greater things over the next few years.

Talking of CAT16, we urgently need your feedback on where you would like to see the event held – ideally we would like to take it somewhere other than Basingstoke and the museum at RAF Cosford looks a great venue, but would **YOU** be willing to travel there? So, if you know of a possible venue, let us know and we need all of you to feedback which of the potential venues you would be willing to travel. Feedback via the forum, Facebook page or email please.

Before CAT16 we have got the exciting prospect of real live pictures on 13cms from the ISS during the schools contacts with Tim Peake – several BATC members, including myself, are involved in the project and more details, including timings of the contacts, can be found at ***https://principia.ariss.org/*** Not only is this an interesting challenge for us to receive the ISS signals, but the Principia mission is a fantastic opportunity to interest young people in science and engineering and the BATC is pleased to be able to support ARISS in the project.

As you will see later in this edition, we are planning more activity days in 2016 – these do seem to be giving a focus to ATV operation and activity is increasing so we've increased them to one a month during the summer. It would be great if more of you could make a note in your diaries of the dates and just make sure you come on your local repeater during the weekend.

So don't forget, this is your club – don't just leave it to the few of us to run it! And please make sure you let us have your feedback on where you want to see CAT16 held.

▶ *The BATC stand at the HAMRADIO Conference in 2015 with Brian G8GQS, Noel G8GTZ and Graham G3VZV.*

Members News

Dave Mann – G8ADM

2m DATV Transmissions, 146.5 MHz

Many people are experimenting with RBTV on 2m and are also planning to add 2m RBTV receivers to their repeater inputs. They report that the picture quality is surprisingly good with just a 500 KHz bandwidth transmission. These include:

Shaun G8VPG and Ivor G1IXF in Bristol have been testing on 2m with 25W ERP produced from a Raspberry Pi hardware and camera. Shaun has found this quite a challenge as he not familiar with Linux. They have been testing to the GB3ZZ repeater site at about 11 miles with good results over this obstructed path with transmit power down to as low as 400mW using 4 element Tonna antennas. Using vertical omnidirectional antennas at both ends they needed to use 2W. So the aim is to eventaually provide a 2m RBTV input to the GB3ZZ repeater. Shaun has sent a screen grab from his 2m signal. He says: *"Not my most flattering angle, but the camera is a tiny device the size of a postage stamp on the end of a six inch ribbon cable, so it is tricky to direct accurately."*

The team from the GB3TZ repeater near Luton are also using this band with very good results. They hope to have a 2m input for the repeater soon. GB3TZís 13cm digital output has been on low power for a while. The PA has recently been repaired and it is now on full power agan.

Peter G8DKC has also been getting good results on the band, he is planning to add a 2m input to the GB3GV repeater at Markfield, 8kms N.W. of Leicester. He is using a big wheel antenna with auto changeover to 2m reception. This should also be in operation by the time you read this.

Mike G8LES near Alton is preparing for this band, he has a 10 element crossed yagi antenna so that he can switch between vertical and horizontal polarisation and he uses a DG0VE 2m up converter. He should be fully operational by the time you read this.

To keep up to date with all these developments see the BATC forum: ***http://www.batc.org.uk/forum/*** and also the BATC facebook page: ***https://www.facebook.com/groups/BATCOnline/***

Other Bands.

70 cm DATV, 437 MHz.

This was the original ATV band, an AM ATV transmission filled the whole band. With the reduced bandwidth of digital transmission interest in this band continues to grow with many station getting good results over long distances.

Peter G3PYB reports that he and Colin G4KLB have been testing between Portsmouth and Bournemouth over an obstructed path. They have been getting very good results using a 1 M symbol rate, 7/8 FEC and the lowest audio bit rate. This achieves an overall symbol rate of just 883 Ms/s. They are using the latest MiniTioune software from F6DZP.

6 m band.

The last time that I mentioned using six meters for DATV I attracted a great deal of criticism from the non ATV amateurs. So I am pleased to report that the IARU, International Amateur Radio Union, have introduced Resolution COM6/6 (WRC-15) that proposes that the six metre band should be extended to 50 – 54 MHz all over the world. Currently those countries outside the Americas that have this band are limited to 50-52 MHz. If this happens then it is also suggested that the new top 2 MHz of the band should only be used for digital communication. This then opens the door for us to transmit DATV at the top end of the 6 metre band with the possibility of very long range contacts. For more information see: ***http://www.iaru-r1.org***

3cm ATV Beacon

Bob G8MBU has installed a personal ATV beacon on 10.342 GHz FM at a high site above Cowes on the Isle of Wight. This is the same location as the 23cm NB beacon. The aim of the project as to determine the coverage of the 10 Ghz ATV signal over the Solent area. The transmitter is delivering 1W to a 10db 180deg slotted

waveguide antenna centred on 266 degrees with caption ident and a picture carousel giving a short series of stills. Initial results are very encouraging.

- G8GKQ in Southampton has no direct path but sees the beacon by reflection.
- Colin G4KLB has seen a good picture on the sea front at Bournemouth, plus a good picture well off the beams -3db points at Worth Matravis behind Swanage.
- G3PYB in the opposite beam direction received a P5 on Portsdown Hill.
- A receiver is to be installed at GB3IV with a view to linking into the RNARS Collingwood site.

The reports were made with a small SKY offset dish and 10G LNC. Based on the success of the above tests, an application has been submitted for a repeater NoV using the original SCART repeater callsign GB3AT.

BVE Exhibitions

There are two exhibitions in the UK each year that show professional broadcast products. It is good for amateurs to keep in touch with developments in broadcasting especially as the shows are free to attend. So instead of using terms such as PAL, NTSC, 625, 525, AM FM etc you need to become familiar with phrases such as DVB-T, DVB-S, 2K, 4K, 8K etc.

The London show is on 23-25 February 2016 at the Excel Centre in East London and the show after that is in the North Of England in the autumn, to be announced. For full details and for free registration see:
http://www.bvexpo.com, see you there.

Please send any news for CQ-TV 251 to me by the end of February ***secretary@batc.org.uk***

Latest developments at GB3GV

Peter Yarde – G8DKC

More work has been done at GB3GV on the 146.5Mhz Rx and Jean Pierre's version of Tutioune for the TT1600 card with TS 22Khz "lock light".

The MK I effort uses the Atom N280, 1.66Ghz thin client. After the 146.5Mhz preamp the Rx is a PYE front end chopped off before the mixer and this feeds a SUP2400 with standard 437Mhz Mods, then passes through a FC-AMPSAT/S line amp.

This then goes into a splitter – one way to the TT1600 card; the other to a SEEBEST SB-S12SA4 22Khz Detector switch. The ON LNB-A output is 13v when there is a 22Khz signal from Tutioune and TS light is on.

The voltage is passed through a pair of rf chokes with .01uf decoupling capacitors scavenged from the "DC Bypass" of a SAC AE5199DC budget satellite attenuator; a 1uf capacitor added across output giving a little delay to stop fast drop out – this can be adjusted when fed into GV's Video Switch. Relay is 'normally closed' in this version.

VLC media player is set to receive the UDP stream from Tutioune, "udp://@127.0.0.1:1234" setup in VLC's network stream. VLC is also set from 'Tools/preferences/ video settings' to run full screen on the Pc's extended monitor e.g. "//./Display2". The output is fed to a VGA to Composite converter box which goes to the port on the video switch, activated by the 13v from the 22Khz SEEBEST detector.

Hoping that Jean Pierre will find the time to put both the TS 22Khz and the UDP switch option into the .ini file so that on power fail or reboot, Tutioune will run up ready to repeat the next signal in from the 146.5 Rx.

Using the SUP2400 with 437Mhz mod, Tutioune setting is 02253500Khz and of course 333KS, 13v on, 22Khz TS on, and UDP on.

The latest arrival is a DG0VE 146.5Mhz up-converter – "Kon146-1100", so will possibly be replacing the home brew 146.5Mhz Rx and SUP-2400 with this after tests have been conducted.

Contest News

Dave Crump – G8GKQ

ATV Activity Weekend 12/13 December

I'm just warming up again after going out portable for the latest activity weekend. I heard of, or saw, activity from:

Call	Location	Locator
M0DTS/P	North York Moors	IO94MJ
G1LPS	Spennymoor, Co Dur	IO94EQ
G3NWR/P	Holme Moss	IO93AN
G4CPE	Upper Sundon, Beds	IO91SW
G8GKQ/P	Butser Hill, Hants	IO90MX
G8GTZ	Basingstoke	
G8GTZ/P	Walbury Hill, Berks	
G8ADM	Pinner, Middx	IO91TO
G8LES	Alton, Hants	IO91LC
G0MJW	Harwell, Oxon	
M0SKM	Dunstable, Beds	IO91RV
G1HBD		
G3KKD	Cambridge	JO02CF

There seemed to be a lot of activity in Southern England, and for the first time in ages we needed to QSY from 144.75 MHz for talkback because it was too busy. A good sign!

I have published a new spreadsheet for submitting activity day logs. You can find it at ***http://www.batc.org.uk/contests/YYYYMMDD_yourcall_Activity_Log.xls.***

This log is a lot simpler than the Contest Log, but allows you to submit all the information that I need to recommend the awards offered for each activity day. Please submit your log to me before Monday 28 December.

I have added 3 extra activity days to the calendar during the Summer. Please try to get on the air on these days - it's the on-air activity that drives most of the innovation in our hobby.

Next Event

The next planned event is the activity weekend on 12/13 March. The aim is simple – to generate as much ATV simplex and repeater activity as possible. Please try to get on the air and then fill in a copy of the log at ***http://www.batc.org.uk/contests/YYYYMMDD_yourcall_Activity_Log.xls*** and e-mail it to me.

Latest News

Remember that you can always find the latest Contest and Activity Weekend News on the BATC Forum. There are links to the rules and the entry spreadsheets there and on the BATC website.

Rob, M0DTS braved the snow on the North York Moors and was rewarded with a 23 cm contact over more than 100 km with G3NWR/P.

Contest and Activity Weekend Calendar

1200 UTC 12 March 2016 - 1800 UTC 13 March 2016:	*ATV Activity Weekend*
1200 UTC 7 May 2016 - 1800 UTC 8 May 2016:	*ATV Activity Weekend*
1200 UTC 11 June 2016 - 1800 UTC 12 June 2016:	*IARU International ATV Contest*
1200 UTC 9 July 2016 - 1800 UTC 10 July 2016:	*ATV Activity Weekend*
1200 UTC 13 August 2016 - 1800 UTC 14 August 2016:	*ATV Activity Weekend*
1200 UTC 10 September 2016 - 1800 UTC 11 September 2016:	*ATV Activity Weekend*
1200 UTC 10 December 2015 - 1800 UTC 11 December 2016:	*ATV Activity Weekend*

BATC report to RSGB Spectrum Forum - Oct 2015

Noel Matthews (G8GTZ) and Graham Shirville (G3VZV)

The Amateur Television Community continues to drive innovation in spectrum use and the last 12 months has seen the introduction of Reduced Bandwidth RB-TV transmissions, the release of 2 new bands for RB-TV use and adoption of 2 more bands for ATV use.

BATC continues to support and drive these initiatives with a program of awards and grants and the use of the BATC shop to purchase and stock otherwise difficult to source components. Whilst the hobby is thriving technically, the BATC is aware that operating levels are still declining – to try and counter this we have awarded a number of prizes for contest winners and have introduced a 3 monthly activity weekend timed to coincide with activity weekends in neighbouring IARU countries.

BATC has also been involved in the setting up of the European ATV Forum (***www.eatf.org***) designed to encourage co-ordination between ATV communities and organisations in European countries and in particular to share knowledge on regulatory and spectrum matters.

TV Repeaters

35 TV repeaters are currently in operation with primary outputs on 4 bands. The 2.3 GHz PSSR reallocation program involved moving 5 repeater input channels and all have now been re-allocated channels mainly on 1.3 GHz with the exception of GB3KM who applied for and were allocated a 5.6 GHz input channel – a first on that band.

The bands

24 GHz — G1LPS and M0DTS have been conducting tests on 24 GHz, a band which is used throughout Europe by ATV operators, but is believed to be a first in the UK.

10 GHz — Activity continues on the band with several repeater inputs / outputs active and a new test ATV beacon has recently been commissioned on the Isle of Wight with a view to applying for a repeater NoV. The team is intending to use a transmit linear mix from 23cms enabling the use of common mixer, PA's and antennas with the proposed Narrow Band 10 GHz beacon. This will enable common use of the very good site for several facilities, an approach the amateur community may need to consider as sites become harder to find.

5.6 GHz — As mentioned above, an input on 5.665GHz has been approved for GB3KM. This was awarded as part of the PSSR program and the frequency was chosen to enable the use of readily available FM ATV equipment designed for drone downlinks. The ATV community will be monitoring performance closely to see if we should adopt the use of 5.6GHz more widely.

3.4 GHz — 2 more repeaters are now on air in the ATV sub segment with 2 MHz wide DVB-S transmissions. Reports continue to confirm that the band performs better than 2.3 GHz, mainly due to lack of interference and the availability of C band LNBs making it easy to build an effective receive system.

2.3 GHz — The re-allocation of 5 repeaters under the PSSR scheme went smoothly, thanks to support of Murray and John McCullagh. We do still have 3 units with outputs operating on 13cms and are looking at the potential of using the remaining segment at 2390 – 2400MHz for further inputs / outputs.

1.3 GHz — Most ATV activity continues to take place on 23cms and we have seen NoVs released for 5 more repeaters in the last 12 months. However, that progress has stopped since the change of personnel at the primary user and we are now seeing significant delays in the NoV process with GB3EY site change still not released after 18 months and no update on the GB3ET application has been received after 3 months.

70cms — The use of DATV continues to revive interest in 70cms and tests with the new RB-TV mode shows signs of even greater DX potential plus the ability to operate between the PU transmission frequencies in the north of England.

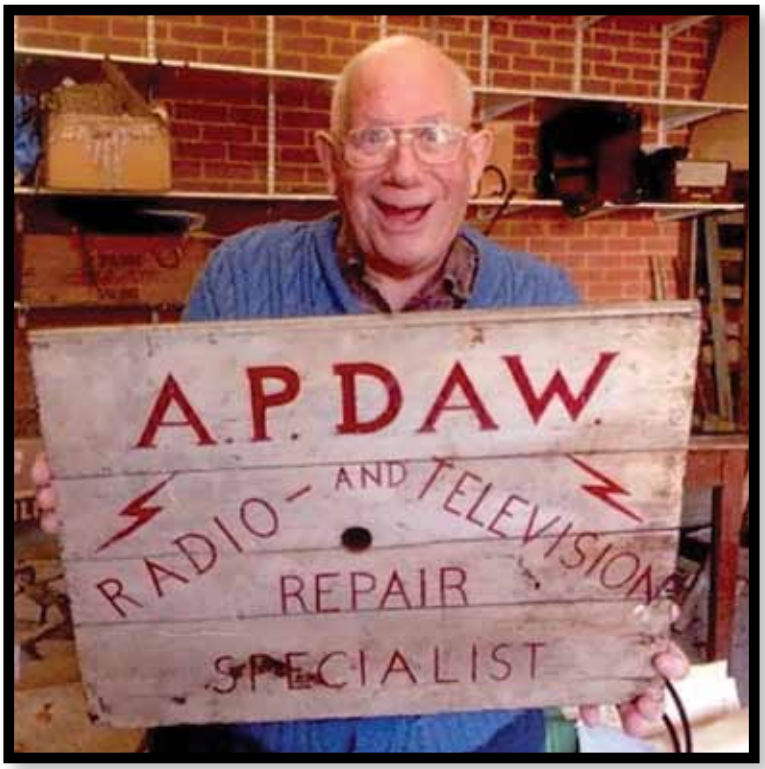
146 MHz — The ATV community has risen to the challenge of using 500 KHz of the new band for RB-TV use. No suitable equipment was available for Tx or RX, but these have been developed and several QSOs of more than 100 KMs using 25 watts erp have been achieved.

This initiative has shown that the amateur community can still innovate and has helped RSGB increase the profile of the radio amateurs as innovators with Ofcom.

70 MHz — As a direct result of the 146 MHz work, a further allocation of 1 MHz was gained at 71 MHz – unfortunately due to a lack of time and resources, no ATV activity has yet taken place on the band. However, given time it is envisaged that ATVers will experiment with the potential application of RB-TV technologies in bandwidths of 125 - 450 KHz on this band, particularly given the potential for propagation via Es modes.

Alan Daw, G1APD - sk

Mike Sanders, G8LES and Thomas Toth, G4ORF



Alan Daw was born on the 10th January 1930 and died 12th October 2015 at the age of 85.

Tom and Mike attended Alan's funeral and conveyed their condolenceses to Muriel his widow and met the family and grandchildren.

Alan started his TV life by building a receiver with a green radar tube for display, to receive the only TV transmitter in existence in those days, the BBC.

He joined the RAF (in those days - called up to do his "National Service") and he selected Radar as his primary subject. He told Tom once that this training would also give him a "trade" as well. After training he spent time in Germany (West of Berlin, RAF Gatow, a British RAF Base) and in the UK. He did relate of some time spent at RAF Tangmere working on landing aid equipment.

After a period of 8 years, by which time Alan reached the rank of Sergeant, he left the service, and from here he went into the business of TV and radio servicing for a period.

Alan joined Mullard Southampton at West End and later at Millbrook to work on Test Equipment, early Computers and RF Test Equipment. His last major company appointment was to look after all aspects of Apprectice Training.

He was constantly sought out, officially and un-officially, for anything having a TV receiver or recorder problem.

Alan was a founder member of the Southampton based SCART group and built his own analogue Solent (G8CMQ) 23cm transmitter and receiver and used to get GB3HV from High Wycombe at his home in Southern Road, West End, Southampton (next to Telegraph Road and Beacon Road). In the true tradition of a VHF and higher radio amateur, his house was on top of a hill.

Alan was also a founding member of the 11th Itchen North (West End) Scout Group and stayed with the group for over 40 years, taking the role as Group Scout Leader until the age of 65. (Officially) Afterward he kept working with the group/parents committee. Later on he was asked to take on a District appointment for a while and was always on hand to help out.

Thomas Toth G4ORF remembers: *"One day in 1981, while we were working on an S-parameter test set up, the subject of JOTA came up. I was going to run a station in Romsey with Andrew Downer, G4OBL. Alan's interest was immediate so I asked Andrew to run Romsey and I obtained a licence for West End.*

"Afterward I told him that he could do the same if he was licenced. Alan replied: '…but I am more interested in TV!' 'Yes, you can do that as well' and I told him how to go about it. The rest is history. "

He brought his enthusiasm for ATV into the scouts, getting them to not only take part in packet radio and HF but also to talk to other ATV scout stations for Jamboree on the air.

This culminated in the link up via G8LES at Four Marks in Hampshire, receiving and transmitting 23cm ATV with West End Scouts, and receiving and transmitting pictures on 70cm analogue ATV to GB3BT at the Telecom Tower in London, so that Scouts at the BT Tower could talk to those directly at West End Southampton.

Alan was never afraid of tackling electronics, even modern surface mount technology.

Alan's enthusiasm for ATV and patience in encouraging young people to learn and engage will be sadly missed.

ARISS and HamTV - Supporting the Principia Mission

Graham Shirville - G3VZV

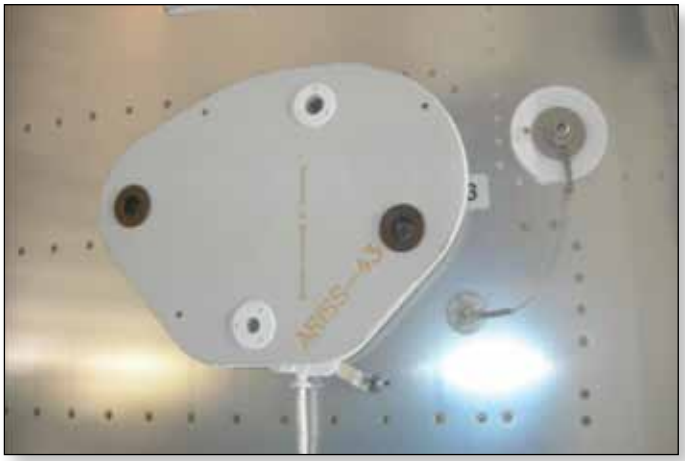
Tim Peake, the first British ESA astronaut, launched to the International Space Station on December 15th amid much coverage by the media. His mission is expected to last almost six months and during that time he will be undertaking a wide range of science experiments. Additionally he has committed to take part in a large number of educational outreach activities with schools and colleges around the country.

Working through contacts established with the UK Space Agency, the ARISS-EU group (Amateur Radio on the International Space Station) have developed a programme which is intended to enable at least six schools to have direct contact with Tim on the Space Station during the duration of his stay. Readers may be aware that these organised "schools contacts" usually comprise of voice only contacts where children pose some twenty questions to the astronaut. These contacts normally take place using amateur radio VHF and UHF radio equipment specially installed at the school for the occasion.

Hopefully Tim's contacts will be slightly different to the norm.

Some fifteen years ago, some BATC and AMSAT-UK members pitched the concept of having an ATV transmitter placed in the ISS to enable such contacts to take place by TV rather than "only" voice. Although nothing directly came of the original proposal, over time, things did happen. Firstly when the European Columbus module was delivered to the ISS by the Atlantis Shuttle in February 2008, it flew with two L/S Band patches antennas bolted to the outside. Some years later, initiated by amateurs at AMSAT-Italy, ESA enabled a specially designed DATV transmitter to be developed and eventually delivered to the module. Arrangements were also made to "borrow" one of the many battery powered cameras that exist on board. During April 2014 the system was tested with live video by means of a demonstration contact undertaken by Japanese Astronaut Koichi Wakata, KC5ZTA . Good signals were received by a number of groundstations around Europe, inlcuding Colin G4KLB, in Bournemouth.

▶ *Koichi Wakata, KC5ZTA conducting the first test transmissions with the HamTV onboard the ISS*



▶ *One of the two patch antennas (ARISS-41 and ARISS-43) on the outside of the Columbus module.*

For the Principia mission, the ARISS team - a joint team of BATC and AMSAT-UK volunteers - led by Ciaran Morgan M0XTD, has been working with Noel Matthews G8GTZ, Frank Heritage M0AEU, Phil Crump M0DNY and Graham Shirville G3VZV to develop a suitable groundstation system to enable Tim to be the first astronaut to use this equipment for actual schools contacts.

As the "link budget" for video signals, even Reduced Bandwidth Digital ATV, is not as easy to meet as for the voice contacts, there are numerous parts of the system that need to work perfectly for this ambition to be realised. High gain dishes, which can accurately track the rapidly moving spacestation are prerequisites. Also required are good low noise S Band front ends that are capable of operating perfectly in the presence of the 2.4GHZ wifi signals nearby. Finally a decoder that is capable of dealing with the Doppler and signal fading that is an inevitable part of such activities.

Luckily F6DZP, Jean-Pierre Courjaud has been very active in developing such a decoder and the vital software that goes with it. He issued a special "ISS" version early in November and this is already performing excellently. More recently others are developing groundstation solutions so keep an eye on the BATC DATV forum for updates

The team have decided that it should be possible to receive the S Band video signals from the ISS directly at the schools but that, in all probability, unlike the VHF link, it is unlikely that the signals will be sufficiently robust for the whole pass – horizon-to-horizon. Therefore, for the operation at the school itself, a special LWB Landrover will be employed using a 1.2 metre dish. This expected to provide direct video downlinks for at least 6 minutes of the pass.

To support this operation the team has also been working with the Satellite Applications Catapult. They are a special company, part funded by the Government, and are based at the Harwell campus in Oxfordshire. However more importantly for us, they also remotely operate a 3.8 metre dish that is located on the estate of the Goonhilly Earth Station Ltd on the Lizard in Cornwall. *(See the cover image of this issue of CQ-TV of the dish being commissioned, and a full article on Goonhilly.)*

▶ *S-Feed and preamplifier on the 3.8 mtr dish located at Goonhilly.*

Very successful initial tests have recently been undertaken using this dish with a downconverter and decoder provided by BATC. With the dish correctly tracking the Spacestation the resultant signals on 2395MHz have been very strong and its decoding of the 2Mbps signals have been decoded for at least 8.5 minutes of the 10 minute passes.

This dish is almost in the shadow of the original 29 metre dish built in 1962 to receive the first transatlantic television signals from the Telstar-1 spacecraft.

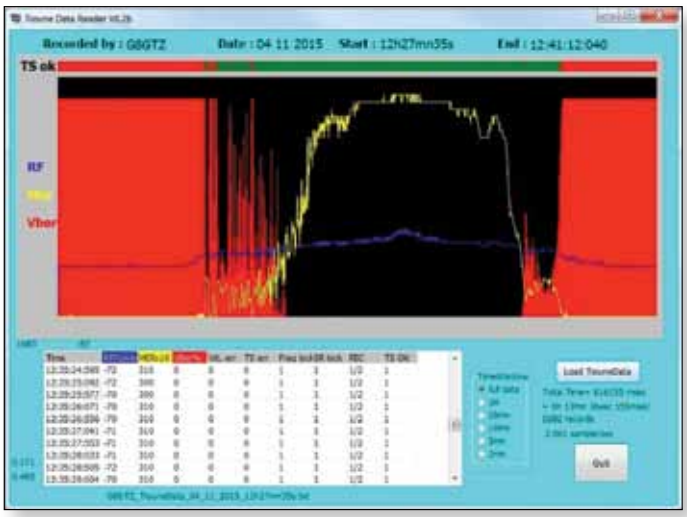
Work continues to further improve the system but the ultimate performance may be limited by a variety of other objects attached to the Spacestation which are actually projecting below the Columbus HamTV antenna and which may be obscuring the patch antenna at oblique angles. *(See the separate article on this subject in this issue)*

The first School video contact is expected to take place in early January and each contact will be web streamed live as it happens. It will also be possible for suitably equipped station to receive the video signals directly and everyone is encouraged to join in.

This work should help ensure that these schools contacts with Tim are remembered by the students as an exciting experience and will help to encourage more of them to consider a technical career after they finish their education.

More details are available on the ***http://principia.ariss.org*** website including a dashboard showing the position of the ISS and the condition of the two receiving stations. There is also a link on the website to the live webstream for the contacts from the schools.

More details of the F6DZP minitutioune decoder and the software can be found here ***http://www.vivadatv.org/***



▶ *Initial tests have shown very strong signals with a MER of 31 on the 3.8 mtr dish at Goonhilly. Video is expected to be received for over 8 minutes on a schools contact.*

Goonhilly Earth Station

Frank Heritage – M0AEU

On three wet and windy days in November 2015 three members of the BATC ventured down to Cornwall for a visit to the Goonhilly Earth Station to commission a 3.8 meter satellite dish for use with the Tim Peake Principia project. Noel G8GTZ, Graham G3VZV and Frank M0AEU are all members of the team providing the ground station for the schools' contacts with Tim during his mission on the International Space Station (full details of the HamTV involvement can be read in Graham's article elsewhere in this edition of CQ-TV).

For all the team members this was their first visit to the iconic ground station - and none were quite sure what to expect from the site of the first live transatlantic television pictures. The site consists of a number of primary antenna - and you can't miss them on the site! In addition to the big dishes there are numerous smaller satellite antenna all providing communications for a variety of companies that hire the facilities.

Antenna 1 - nicknamed 'Arthur' - is 26 meters wide and was the world's first parabolic satellite communications antenna, built in 1962 to communicate with the orbiting Telstar 1 satellite. British viewers would have Arthur to thank for their first live transatlantic TV pictures and coverage of such events as Muhammad Ali fights, Olympic Games and for the first moon landing.

By 2006, however, Arthur was being prepared for retirement. Goonhilly Earth Station, once the largest satellite earth station in the world and home to over 60 such antenna, was then owned by BT who announced plans to close it by 2008, describing it as "no longer commercially viable". Goonhilly was earmarked for demolition – to be replaced in part by a wind farm, with some outbuildings leased to other businesses. While Arthur would survive as a Grade II-listed building, Goonhilly's role in the space age would be at an end.

Ian Jones heard about the plight of the site and considered it might be possible for a smaller company to make Goonhilly commercially viable again - not only with satellite companies, but also working with academic institutions to convert some of the antenna for deep space communications and radio astronomy. Ian went on to form the 'Goonhilly Earth Station Ltd' company and bought the site from BT - thus saving the iconic site from destruction.

During the visit Goonhilly'6' was being reconditioned and prepared to enable it to track fast moving low earth orbiting satellites. This could include the ISS and this 32 meter dish will have the capability to track the space station across the sky - now imagine the reception of HamTV you would get with a dish of that size!

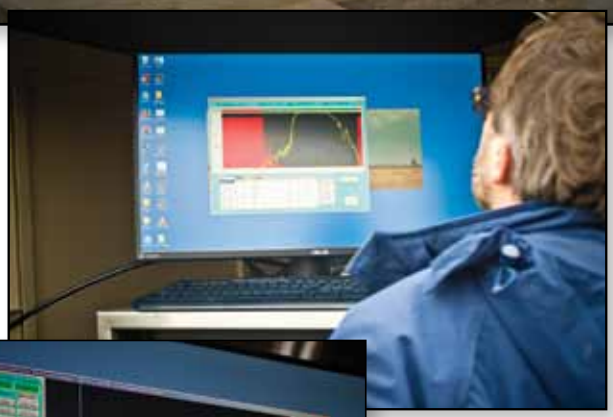
Arthur is still fully functional and currently being prepared to be brought back into service, with a new receiver and an upgrade to the tracking equipment. However, it's not fast enough to be able to track the fast satellites - the ISS included.

The main site at Goonhilly is restricted, and not open to the general public. The original visitor centre was closed by BT back in 2010 - however there are plans to refurbish it and re-open it to the public as a space centre, showcasing all the new work at Goonhilly. No date is currently set for the re-opening.

▶ *'Arthur' - Antenna 1 and GHY99… Little and Large*

The main objective for the visit to Goonhilly was to commission the use of GHY99 for HamTV reception for the Principia project. The 3.8 meter dish is being loaned to the project by Satellite Catapult, ***https://sa.catapult.org.uk/*** and will be used to track the ISS and provide real time video from the ISS during the schools contacts scheduled for early in 2016. This dish is almost in the shadow of Arthur and the team couldn't resist the odd photograph in front of the famous dish while working on GHY99.

The visit to Cornwall had been timed to coincide with the best passes during working hours of the ISS, so the set-up could be tested while we were still on site. Although the HamTV transmitter is still only sending a blank screen, it was possible to receive the signal and assess the quality of the link and check the tracking of the dish.



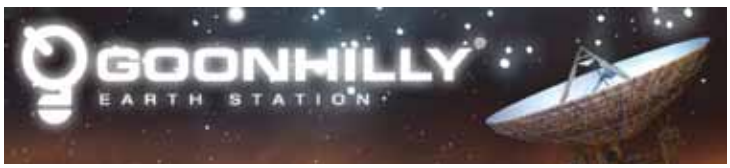
Despite initial technicalities the first passes from the Space Station were looking very promising, with excellent signals received down to just a few degrees above the horizon on ascent and descent. However subsequent passes suggested there was still something amiss with the dish and its tracking and BATC team eventually had to leave the Catapult team to diagnose the problem over the following week. This was eventually traced to a faulty hardware sensor which once replaced resulted in excellent reception from the ISS again.

Whilst on site Graham G3VZV couldn't resist the opportunity to try and receive the video signal from the ISS with nothing more than a handheld 60cm dish and receiver in the back of his car. To his amazement he was able to track the space station and achieve video lock, receiving several minutes of the video. Who needs a big dish?

Before leaving the site, the team were treated to a full tour of the facilities, including up inside the operations rooms of the main dishes. These are very high power

facilities and it was fascinating to see the mechanisms to allow for the dish and in some cases the whole top of the tower to be rotated and elavated. Moonbounce ATV anyone?

For more information about Goonhilly visit: ***http://www.goonhilly.org/***



Variable SR filter for RB-TV

Colin Watts – G4KLB

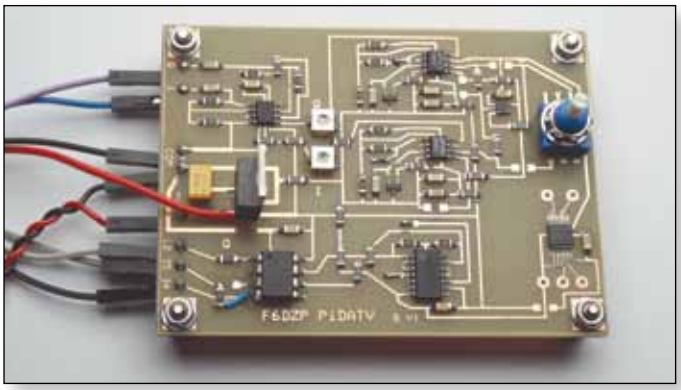
Jean-Pierre F6DZP posted some information on the BATC forum
http://www.batc.org.uk/forum/viewtopic.php?f=15&t=4388

And I quote

"I have found a solution for building an interface for the Raspberry Pi that can filter all SR values between 100kS/s and 650 kS/s, just using a potentiometer. This potentiometer will be changed to a digital potentiometer MAX5478-EUD+ (Radio Spare) in the next developments and the raspberry Pi will be able to setup the frequency we want for the SR chosen via I2C. We will be able to choose any SR we want below SR650 kS/s and the filter will be adjusted.

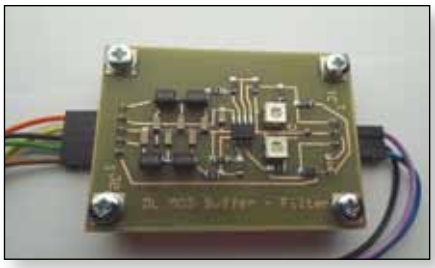
No PIC, no DAC, no processor, just the use of a little chip from Linear Technology: the LTC1569-7.

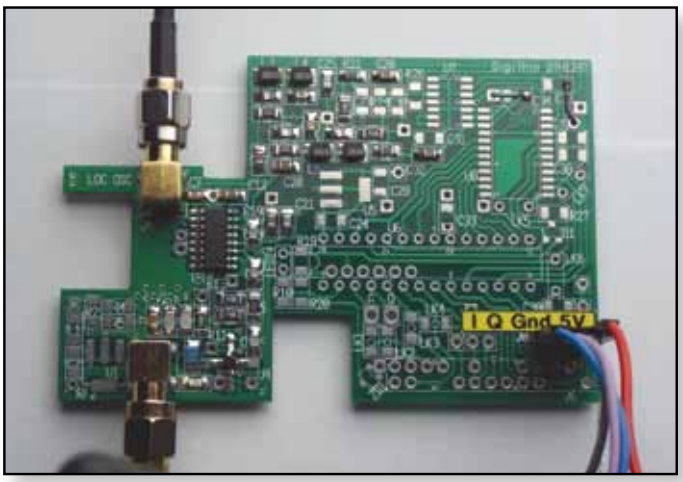
I have just plugged the IQ output of my prototype filter in the end of a DigiThin to use the U2970B already made and it works well, as it is only made on a veroboard…" Jean-Pierre F6DZP.



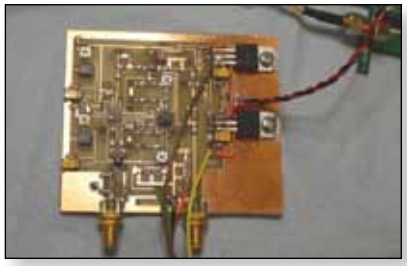
After discussing it on the GB3SQ net my friend John in America quickly drew a prototype PCB, which changed many times over the following week. For ease of construction it was made single sided, and included several parts that could be configured in or out for experiments.

It was also realised that this method could also be used to feed a Digilite modulator, the levels required are slightly different so a buffer/filter board was also designed to make the modulator interchangeable without needing adjustment.





I built the Raspberry Pi interface; a DigiThin with just the filter and modulator; as well as a MK5 Digilite (Just the modulator) and the buffer/filter PCB to match the output from the Pi interface.



After looking at Jean-Pierre's circuit and the data sheets for the components, we had several ideas that we wanted to experiment with, but I was keen to build the first one as close to the original as possible, the only change we made was to use a dual op-amp, but essentially the circuit was the same.

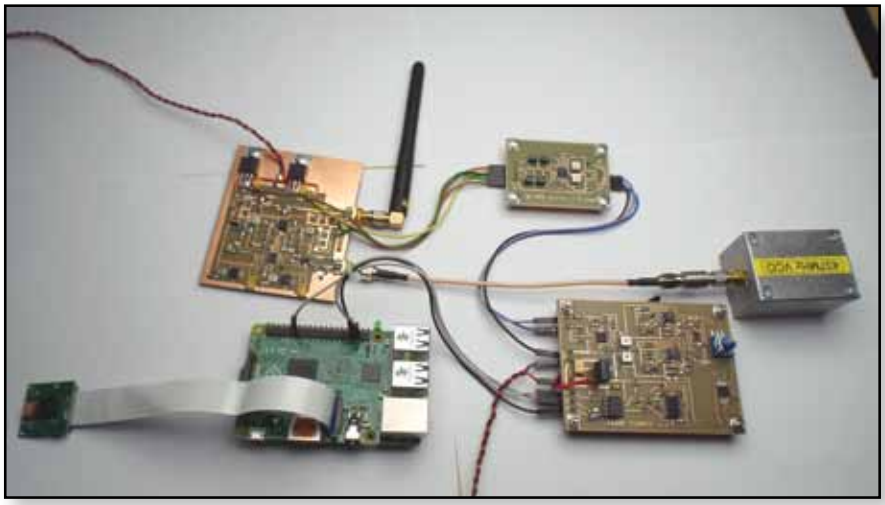
The dual pot I was using had two much variance in resistance between the tracks, I padded it out for the first test, which was successful, but the amount of difference wasn't consistent. A higher quality pot should work just fine.

The LTC1569IS8-7PBF Tunable, 10th Order Lowpass Filters - which are the main components - can alternatively be controlled by an external clock signal. We already had a LTC6900 clock oscillator on the PCB for this test, so now both filters can have exactly the same control signal using only one pot.

My first test worked fine at SR333, but attempts at any other symbol rate didn't work, I asked Jean-Pierre what model Raspberry Pi he was using and he told me it was a mode B+. When I was setting this up, I realised that I still had the Pi set for a DigiThin board and it needed to be configured for external I Q modulator - after this change my Raspberry Pi 2 worked as well.

I have set up the DigiThin type of modulator (U2970B) for 70cm and the DigiLite type (AD8345) for 2M… of course it would work just as well the other way round! Development is still ongoing but I have had both methods working very well down to as low as SR125!

No additional software is required, this has used Evariste F5OEO's standard RpiDATV1.2.1.img.



▶ *Results at SR125*

▶ *Results at SR250*

CAT16 – Where do you want it?

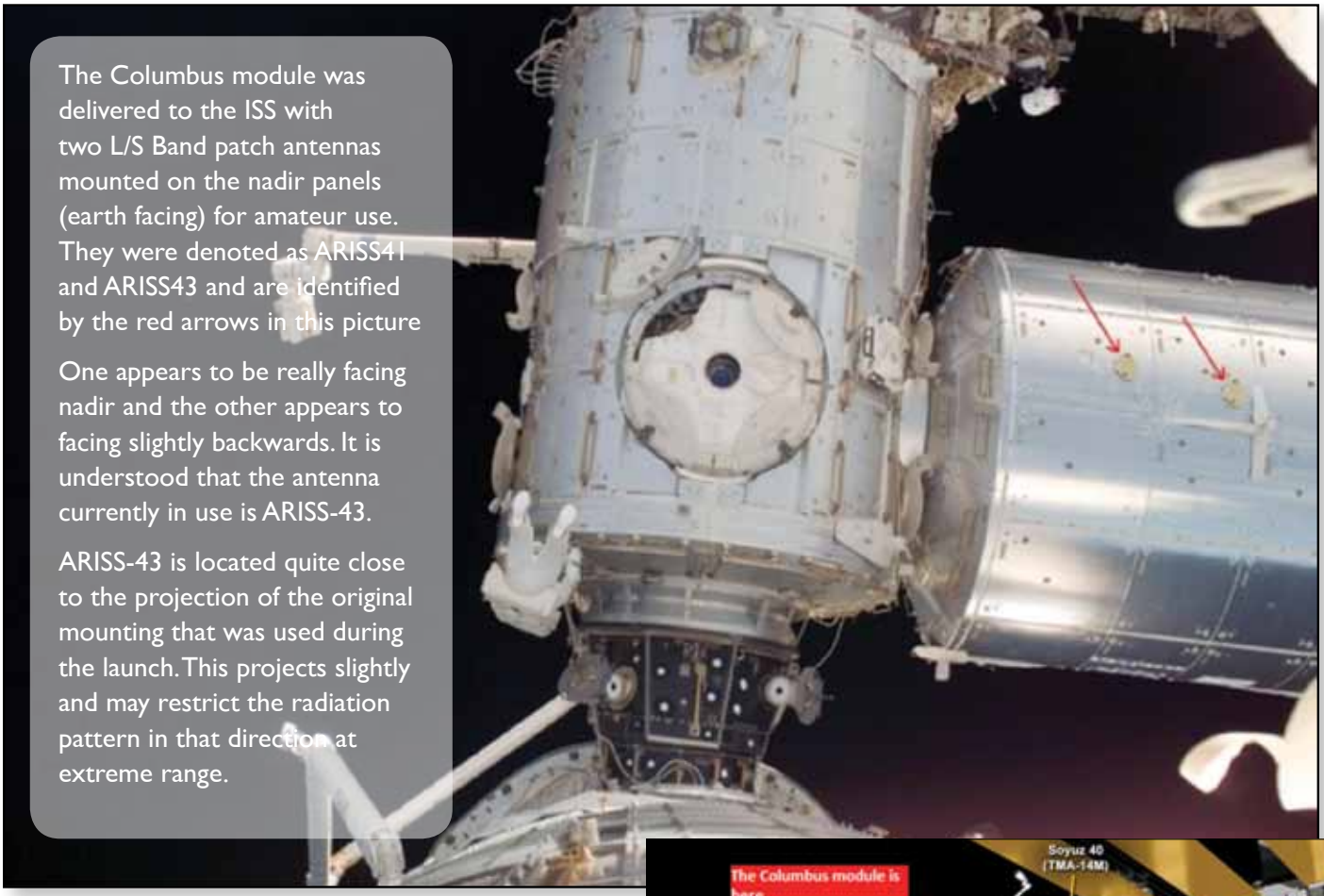
We are looking at a number of options but we need you to tell us where you would travel to.

- Cosford RAF Museum - Telford
- The home of GB3ZZ in Bristol
- Everest Academy Basingstoke
- Another site that you know about!

- Reply on the forum or email asap with your ideas

The HamTV antennas on the ISS

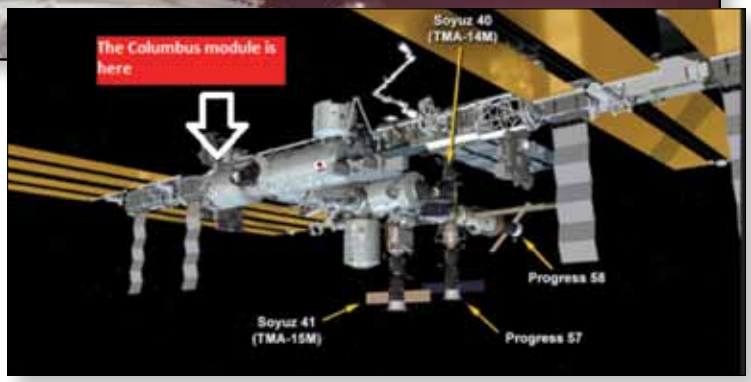
Graham Shirville - G3VZV



The Columbus module was delivered to the ISS with two L/S Band patch antennas mounted on the nadir panels (earth facing) for amateur use. They were denoted as ARISS41 and ARISS43 and are identified by the red arrows in this picture

One appears to be really facing nadir and the other appears to facing slightly backwards. It is understood that the antenna currently in use is ARISS-43.

ARISS-43 is located quite close to the projection of the original mounting that was used during the launch. This projects slightly and may restrict the radiation pattern in that direction at extreme range.



The ISS is understood to be nominally travelling in an attitude which means that the Columbus module is at the front of the spacestation (hence the micrometeorite absorption panels).

This picture comes from this excellent isslive site: ***http://isslive.com/displays/adcoDisplay1.html***

Although the antennas appear to have a clear view looking forward, looking behind the antennas a varying number of obstructions can be seen. There are some fixed thermal radiators and a variety of Soyuz and other spacecraft that come and go over time.

Recent testing of the HamTV downlink signals, undertaken during high elevation passes, demonstrates that the signals are weaker than expected immediately following Acquisition of Signal (AOS) and build up only when the elevation angle is around 20 degrees. After Time of Closest Approach (TCA) the signals generally remain strong until only a few degrees above the horizon.

During the passes we generally see dips in the received signal levels which we assume are due to the obstruction to the signals brought about by the objects attached to the ISS below the antennas. *(See the receive monitor screenshot on page 31 of this issue)*

It would be great to have these observations confirmed by some experts in this area!

Using the SUP-2400 for 146.5 MHz Reception

Dave Crump – G8GKQ

The BATC Shop stocks the SUP-2400, which has proved to be a very effective up-converter for receiving 70cm DATV signals on an unmodified domestic DVB-S satellite receiver. When modified as recommended by Rob, M0DTS on his website at www.m0dts.co.uk/index.php?tag=DATV&item=90, the SUP-2400 has a noise figure of about 3 dB at 437 MHz with good phase noise and strong-signal performance; all that is required to complete the receiver is a 70 cm preamp between the converter and the aerial.

An alternative to making Rob's hardware modifications is to use a DiSEqC encoder as described in this issue by Roy, G7DOE to switch the SUP-2400 into its up-converting mode. All the tests below were performed on 2 units with the hardware modifications, but should read-across to unmodified (DiSEqC switched) units.

Use at 146.5 MHz

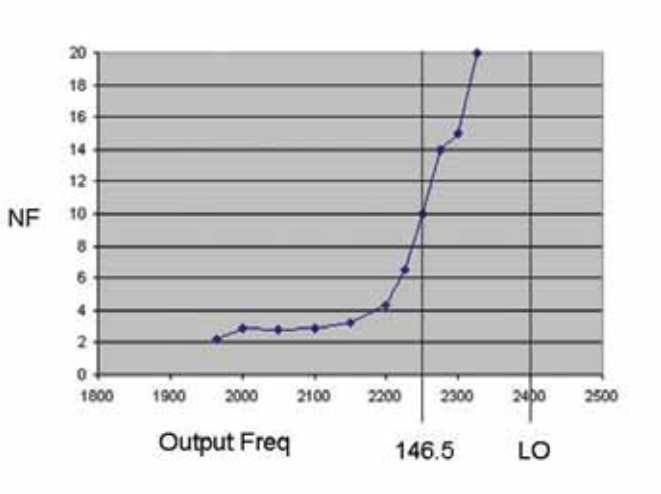
There are 3 problems with using the SUP-2400 for reception at 146.5 MHz: Low sensitivity, the fact that the up-converted frequency (2253.5 MHz) is outside the normal Satellite IF passband of 950 – 2150 MHz, and the presence of spurs in the passband.

Low Sensitivity

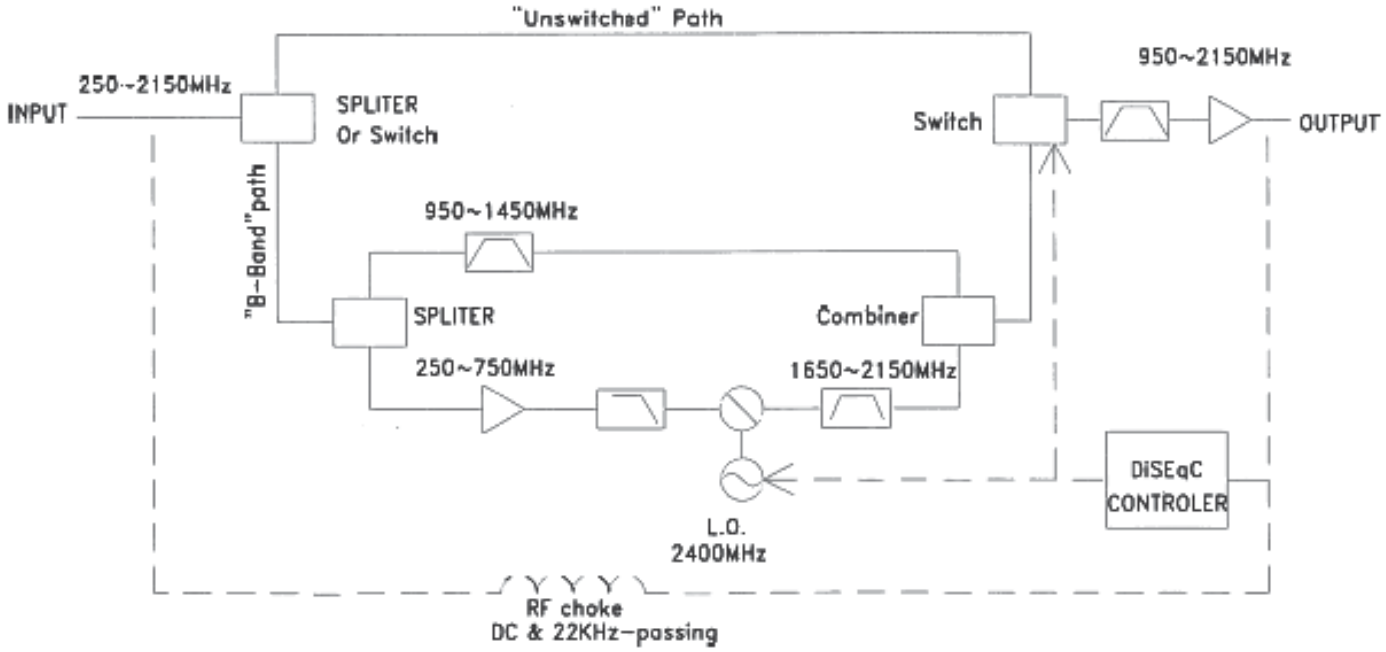
There are band bass filters both before and after the mixer in the SUP-2400. The input filter is nominally 250 – 750 MHz, but does not cause too much attenuation at 146 MHz.

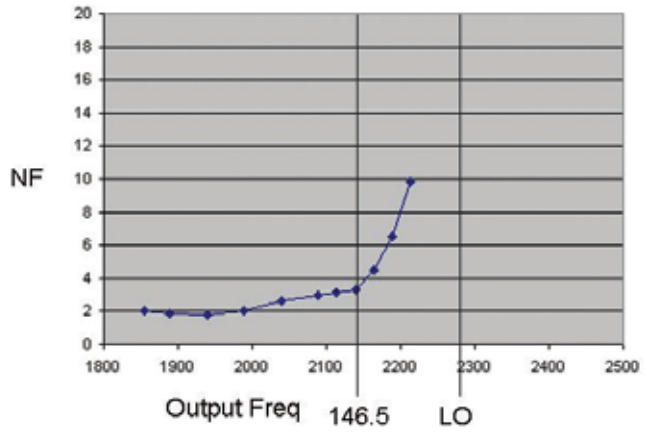
There are 2 output filters: the first is just after the mixer and passes 1650 – 2150 MHz; the second is just before the output and passes 950 – 2150 MHz.

Typical measured noise figure of a system including a SUP-2400 modified for 437 MHz is shown below.



The Noise figure has increased to about 10dB at 146.5 MHz. If the LO frequency is reduced to just under 2300 MHz (see next section) the 146.5 MHz signal can be brought inside the passband of the output filters and the noise figure can be minimised to about 3 dB. The result is shown over the page.



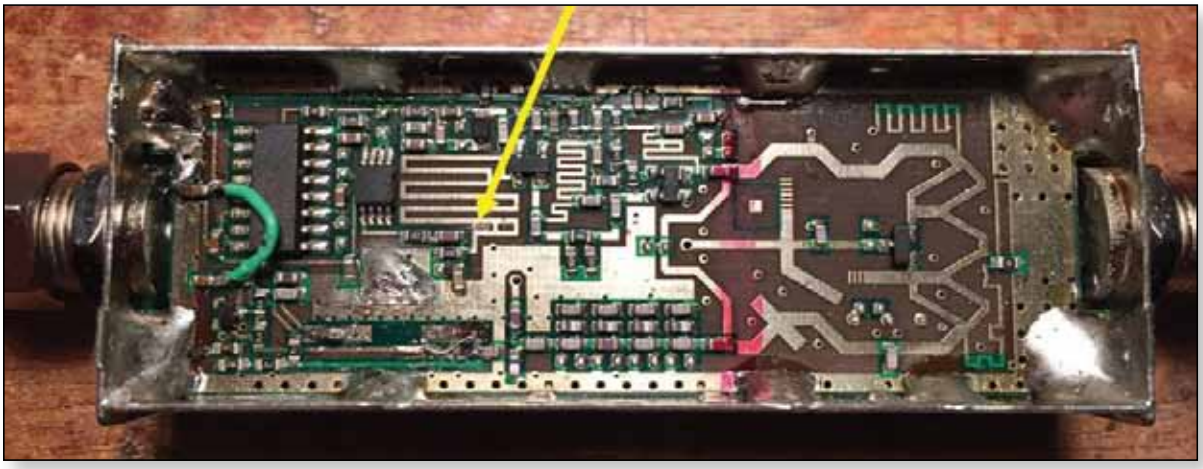


Changing the Up-converted Frequency

The local oscillator is a Voltage-Controlled Oscillator running at 2400 MHz driven by a phase locked loop with a 9.375 MHz (2400/256) reference crystal. The crystal can be changed by shaving away the solder blob that holds it in place with a Stanley knife, and then unsoldering carefully at each end (it is very easy to lift the tracks from the PCB as I found!). Some experimenters report that they have been able to change this crystal for an 8.912 MHz one and move the LO to 2281.5 MHz (=256 * 8.912 MHz). I tried this, but could not get the VCO to come down far enough in frequency. The limit on my VCO was about 2295 MHz and this ties up with what Rob, M0DTS, found – his would not go below 2300 MHz.

There does not seem to be an easy component modification to lower the VCO lock frequency, but I did find that by cutting one of the tracks on the PCB inductor, I was able to lower the range by 15 MHz or so. This was sufficient for me to achieve a reliable lock at 2289.1 MHz using an old Radio Control crystal from my junk box marked 26.825 MHz. In fact this was a 3rd overtone crystal with a fundamental at 8.942 MHz. There is a second adjacent track that could be cut to lower the frequency even further, but I did not need to try this. See below.

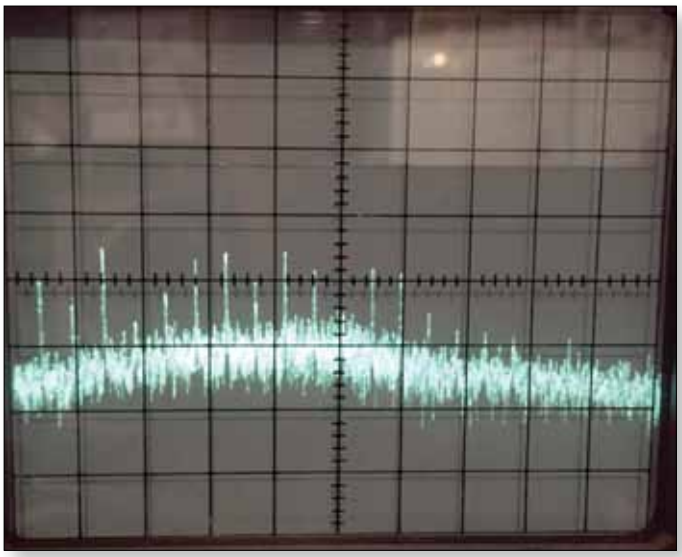
▶ *Cut track here. Note: Crystal removed.*



The change of crystal and inductor can lower the LO sufficiently to put the up-converted 146.5 MHz signal within the passband of normal DVB-S tuners. additionally, it brings the signal within the passband of the output filters, increasing the system gain and reducing the noise figure. However, it does increase the LO leak-through as the unit is designed to filter out a 2400 MHz LO, not a 2289 MHz LO; in my case this increased the LO leak-through by 6 dB. Note that there is room in the case for a full size HC49/U crystal.

Spurs in the Passband

When I was measuring the Noise Figure at around 146.5 MHz, I was initially finding it difficult to get reliable results. On checking with a spectrum analyser, I found that there were spurs at harmonics of half the crystal frequency in the output signal.



▶ *10MHz/div, 10 dB/div centered on an up-converted frequency of about 150 MHz*

These spurs seem to be due to an earth loop from the PLL, which is on the upper side of the PCB opposite the input circuitry on the lower side.

On my unit I found that by bridging between the outer of the input socket and the grounded edge of the PCB, I could reduce these spurs to a much lower level. The exact position of the bridge seemed to be critical. After removing the (disconnected) input choke, I made a solder bridge as pictured below.

▶ *Remove disconnected choke*

▶ *New solder fillet from board to input connector*

The spurii were present at all crystal frequencies on modified units, but I have not tested whether they were present on un-modified (DiSEqC-switched) units.

In Practice

To achieve optimum performance, a 146 MHz or 437 MHz preamp will be required in front of the SUP-2400 to achieve the required signal level at the input to the satellite tuner. Satellite tuners are designed to work with about 40 dB of preceding gain, and the SUP-2400, as modified, has more like 20 dB of gain. Some users also report that a 20 dB industry-standard Satellite TV in-line amplifier after the SUP-2400 works well. Additionally, tight filtering (before and/or after the preamp) is also required to make sure that the satellite tuner only sees the desired RB-TV signal. Short APRS transmissions on 144.8 MHz can be particularly troublesome and need to be filtered out.

Conclusion

By changing the crystal in a SUP-2400 to one of about 8.94 MHz (or a 3rd overtone crystal of about 26.82 MHz) it is possible to receive 146.5 MHz with around 3.5 dB noise figure, whilst retaining (or improving) the performance at 437 MHz. The modification also brings the output within the normal satellite receiver passband of 950 – 2150 MHz, but is worthwhile for the sensitivity improvement alone even if you have a (Sharp) tuner that covers a wider range. Improvements to the grounding near the input connector can reduce spurs that appear near the 146.5 MHz signal.

An outing for the LDK5 camera

Brian Summers – G8GQS

▶ *Veteran cameraman John Pilblad reunited with the camera*

My Philips LDK5 camera has had a busy autumn, it has been out on demo 4 times. Most recently at the BBC OB's annual get together for retired staff, called "Telobians". This was the most nerve racking event of the 4 outings, the chaps there had used these cameras for real and it would be a bit of a memory trip for them.

In many ways this camera was revolutionary, The CCU was dispensed with and replaced with a base station comprising a power supply, reception unit and a surveillance unit. All the vision processing was done in the camera head with digital control signals on the Triax. A modular plug in board system made first line maintenance quick and easy. A sister camera, the LDK25, used camera cable (TV36) for studios.

The analogue function values are stored digitally in a MOS memory, this is supported by a backup (two) batteries so that values are not lost on power off. The memory is claimed to use only 1 microwatt of power!

The LDK5 was the mainstay of BBC OB's fleet and the main type 5 scanners had 8 cameras. It was even used as the camera for the Roving Eye. A Citroen was often chosen as the host vehicle because of it's excellent smooth ride, very necessary when you are motoring along the side of the race track, none too smooth!.

The LDK5 is one of the 100 plus cameras in the collection that supports ***www.tvameramuseum.org***

Amateur Television "Getting Started"

Part 1 - An overview of UK ATV

Due to popular demand we're running a series of articles on getting started in Amateur Television, from first principles through to the latest techniques. These will appear in CQ-TV over coming editions and will also be available as booklets and leaflets for anyone interested in getting started. As always we're looking out for contributors - contact the Editor if you have an idea for an article or help guide please. To start here are the first two articles on ATV and RBTV

Whether it's watching live video from the International Space Station, helping produce programs for live streaming of the AMSAT colloquium conference, building pre-amps and high power amplifiers for the microwave bands or developing high speed data links to carry digital TV signals, the world of ATV has something to interest everyone!

So what exactly is ATV?

ATV is a fascinating area of our hobby which covers all aspects of video production, editing, transmission and reception. This article is about Fast Scan TV which means we transmit and receive pictures in the same quality as you receive from local and national TV stations such as BBC and Sky.

Amateur Television has always been at the forefront of the technology revolution. Many stations are now transmitting Digital pictures (DATV) using the DVB broadcast standards and also using internet video streaming technologies to exchange pictures with ATV operators around the world.

Repeater	Time of net (UK)
GB3SQ - Bournemouth	Sun – 8pm
GB3TM	Sun - 8pm
VK2RTS - Sydney	Mon – 11am
GB3HV – Farnham	Tues – 9pm
W6ATN	Wed – 3:30am
VK7OTC – Hobart	Wed – 10:30am
GB3NQ – St Austell	Wed – 8pm
GB3BH - Watford	Wed – 8pm
GB3VL - Lincoln	Fri – 7pm
GB3EN - Enfield	Fri – 8:30pm

How do I get started?

The first place to start is to go to ***www.batc.tv***, the British Amateur Television Club's (BATC) video streaming portal where you can view most of the UK TV repeaters along with some from Australia, USA and South America. These are streamed live along with a live interactive chat room so you can join in the discussion. Most repeater groups have regular net nights – see the table – and all welcome new comers to the interactive discussion.

Once you have caught the bug and want to know more, the next thing to do is to join the BATC ***www.batc.org.uk*** – it only costs £6 a year for a cyber membership and gives you access to whole host of information.

What is the BATC?

Most ATV operators are members of the BATC which has approximately 950 members, 80% of whom are in the UK. The BATC publishes a quarterly magazine called CQ-TV, runs an on-line shop to support home constructors with difficult to obtain components and sub-assemblies and runs a lively members' forum where you can ask questions and learn more about the hobby. It also represents the ATV community on the RSGB ETCC (Emerging Technology Co-ordination Committee) and the RSGB Spectrum Forum and generally represents the interests of the ATVers around the world.

Which band and where?

Because of the bandwidth required to transmit live broadcast quality pictures, Fast scan TV is normally

transmitted on the higher frequency bands and can be found on 70cms and above. In the UK we have adopted the DVB-S standard which uses QPSK modulation which has the benefit of variable bandwidth depending on the bit rate used for the video transmission.

However, in the UK we have recently been allocated 1 MHz of spectrum at 146 MHz for DATV experimentation. Due to the narrow bandwidth, this requires the use of new techniques which we have called Reduced Bandwidth TV (RB-TV). This is not covered by this article but is the subject of separate "Getting Started" articles and a special edition of CQ-TV available for free download at ***http://www.batc.org.uk/club_stuff/rbtv.pdf***

70cms - The reduced bandwidth of digital transmissions compared to analogue signals means ATV on 70cms is going through a revival in interest. Analogue TV had previously used Amplitude Modulation and occupied up to 6 MHz bandwidth. In the mid-1980s, as the 70cms band was reduced in size and became more occupied, using that amount of bandwidth became increasingly difficult to justify. Also analogue satellite TV technology was becoming available which enabled analogue FM TV transmissions on

23cms and so interest in 70cms declined. However, the recent introduction of Digital ATV (DATV) has enabled operators to transmit broadcast quality pictures in a 2 MHz bandwidth and we are once again taking advantage of the great propagation to be found on 70cm. Simplex activity is centered on 437 MHz and several stations in the South of England have worked French DATV stations and M0DTS/p regularly works stations at a distance of over 200 Kms on the BATC activity days.

23cms – This is the most widely used band for ATV operation and there are currently 23 licensed repeaters in the UK with a mixture of analogue and digital outputs between 1308 and 1318 MHz and inputs on 1248 MHz. Simplex operation takes place between 1255 MHz and 1275 MHz and broadcast quality pictures using FM are regularly exchanged over distances in excess of 100 KM.

For details of all UK TV repeaters see the ETCC web site which has a full and up to date list ***http://www.ukrepeater.net/repeaterlist5.htm*** along with links to repeater group websites. Most repeaters are now equipped with either DATV receive or transmit capability or both and noise free pictures can be achieved when a digital input signal is relayed via a digital output.

13cms – This band was used by ATV operators, however the recent Ofcom changes means that several repeaters have had to move out of the band. There is still room for Digital ATV operation but it may be worth checking with other ATV operators and the BATC before committing too much time and effort to get on the band.

9cms – The 3.4 GHz band is the latest band for ATV activity and the UK band plan allows DATV operation between 3404 to 3410MHz. There are currently 3 repeaters in operation on 9cms and the tests done by these groups show very good coverage results and it looks like becoming an important band for ATV operation.

3cms – 10 GHz has always been used by ATVers as it is quite easy to make transmit and receive equipment for that band. There are currently 7 repeaters with outputs on 3cms and coverage on 10 GHz is surprisingly good - a high performance receive system is easy to achieve with just a mini satellite dish and modified LNB.

It's not all about radio!

There's a lot more to ATV than transmitting and receiving – many ATVers are also members of the local video club and combine the two hobbies. A lot of amateurs also have an interest in railways or planes and these tend to be favourite topics for the videos transmitted on activity nights, alongside the latest technical achievements in the shack!

An Outside Broadcast Van being refubished by ATV enthusiasts

A number of ATV operators specialize in renovating old cameras and studio equipment and some even renovate complete Outside Broadcast vehicles!
http://projectvivat.co.uk/Vivat/Home.html

▶ *Noel G8GTZ and Peter G3PYB streaming an event live to the web via the BATC Streaming Server*

The BATC runs a live production desk which is used to stream live events such as the annual AMSAT-UK Colloquium, Microwave Roundtables and conferences. This gives our members an opportunity to "get behind the camera" and be involved in production of live TV for the batc.tv streaming video website. The BATC team have been present at the AMSAT UK meetings for the last couple of years and provided live streaming of the lectures along with recordings which are made available for later viewing on the BATC streaming website.

Perhaps our biggest and most successful event to date has been the EME 2012 conference held in Cambridge. For this, the BATC team videoed and edited all the presentations, which were then made available to a worldwide audience on the BATC streaming site within 30 minutes of the talk finishing.

RSGB news and video library

Videos of all the events we have produced, including the EME 2012 conference and the BATC conventions are available in the film archive section of batc.tv and the BATConline YouTube channel.

A recording of the Sunday RSGB news broadcast by Roy, G8CKN, is available under the news desk section on batc.tv is and updated each week.

Why should I do ATV?

As well as being a fascinating hobby for operators and those with a technical interest, more and more amateurs are discovering how ATV can complement their own interests and make it accessible to more people.

Lincoln Shortwave radio club transmitted live pictures into GB3VL, the Lincoln TV repeater, from the their special event station GB70DAM from RAF Scampton to commemorate the 70th anniversary of the Dambusters raid. GB3VL is streamed live on the BATC streaming site and so attracted a large number of viewers from around the world to see the station behind the voice on 40 meters

And the amateurs involved in the High Altitude Ballooning Community are using Amateur Television to transmit pictures of balloon launches back to their local repeater which in turn is streamed live on ***www.batc.tv***.

So how do I get on air?

The first thing to say is that transmitting and receiving ATV need not be expensive or complicated.

The first step is to decide which band you are going to focus on. If you already have a well equipped narrow band station with a beam you are half way there! However, as the bandwidths of digital ATV signals are 100 times greater than a FM voice signal and 6 times wider still for analogue ATV signals, squeezing every last bit of system performance is important

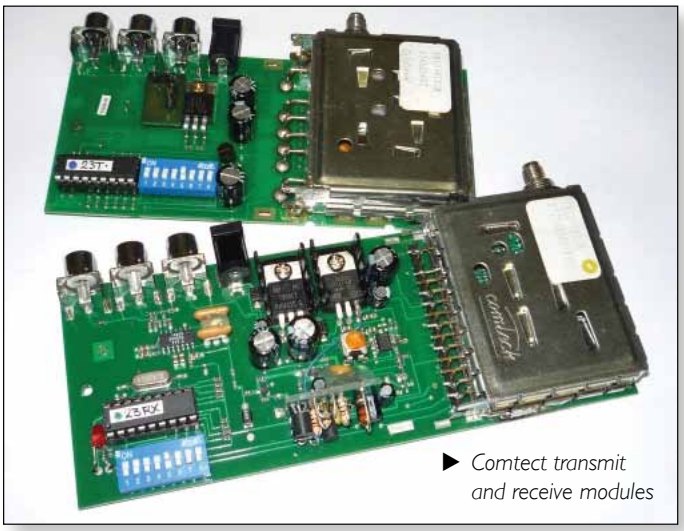
A long yagi or beam is needed to work any distance and in order to achieve reasonable results on any band it is essential to use a mast head pre-amplifier. The latest generation of MMICs mean that a sub 1dB noise figure and very good cross modulation performance can be achieved from very simple designs which are easy to build and at very low cost. A pre-amplifier based on the SPF5043 which has extremely good performance at 70cms, 23cms and even 2.3 GHz is available at a cost of only £13 ***http://www.g4ddk.com/SPFAMP.pdf*** .

The pre-amp should be mounted in a waterproof box as close as possible to the antennae feed point, along with a

change over relay if transmit operation is envisaged. As the system noise figure is already determined by the pre-amp, and as long as the cable run is not longer than 20 metres, good quality satellite TV co-ax can be used to connect the pre-amp to the receiver in the shack and also feed DC power up to the pre- amp and antennae change over relay.

Receiving 23cms

Receiving 23cms ATV and DATV is easy! This is because 23cms lies in the middle of L-Band, which is the group of frequencies that domestic satellite systems use to send the signal down from the LNB, mounted on the dish, to the Set Top Box (STB) in your living room. Therefore any analogue satellite receiver or the very basic Free to Air (FTA) Digital STB from eBay or Maplin will tune 23cms without any modification.



▶ *Comtect transmit and receive modules*

Analogue satellite receivers are becoming hard to find, even at rallies. However, there is an alternative in the Comtech receive and transmit modules, which are actually more suited to ATV operation, due to their narrower bandwidth and are used by the majority of ATV operators. These are available, ready modified for use on ATV from Roy G8CKN ***https://batc.org.uk/shop/3rdparty*** .

Even with a mast head pre-amp most receivers will require additional gain in the shack for optimum performance. A satellite L-band line amplifier (available from many suppliers on eBay) will work in most circumstances and if you live in a noisy RF environment, you may need to provide some band pass filtering.

For FM ATV reception, all you need to know is the frequency of the other station or repeater. But to be able to receive a DVB-S signal you will need to know the symbol rate (effectively the bit rate) and possibly the FEC to set your receiver up with the correct parameters along with the frequency of the transmission. Typical parameters for 70 cms are 2Ms/s or for 23cms at 4Ms/s either at ½ or ¾ FEC. Exactly how these parameters are entered and the receiver is tuned depends on the make and model of STB.

Note, the box MUST be able to receive free to air broadcasts and a SKY or similar dedicated satellite service box will NOT tune to the DATV parameters. It is also possible to receive DATV signals using a PC DVB-S or S2 satellite tuner card. Once again the set up of the card and software will differ between products but they provide surprisingly good results.

Receiving 70cms

The reason why it is easy to receive 23cms ATV and DATV signals is that the satellite boxes tune L Band (950 – 2150 MHz) which includes 23cms. However, in order to receive 437 MHz (70cms) DATV on a standard satellite STB, you need to up convert the signal to L band.

Luckily there is a consumer device available in the USA which is used on cable networks to up convert UHF signals to L Band where they are then received on a standard satellite box. These units are made by a company called Zinwell and known as SUP-2400. They are available on eBay, but only in the US and they do require modification, which involves SMD components, to work on DATV. M0DTS has documented the modifications and the BATC shop ***https://batc.org.uk/shop/hardware-and-kits*** sells the unmodified units.

Once modified, they are placed in line between the mast head pre-amplifier and the standard digital STB and tuned to the up converted frequency. Note that the same digital satellite receiver can of course be used for 23cms and 70cms and just retuned depending on which band is being received.

Receiving 9 and 3cms

Receiving the higher frequency bands is actually easier than 23cms or 70cms as we can use commercial satellite downconverter units. These are readily available on eBay and other online sites and can be used with the Free-to-Air satellite receiver described above.

Transmitting ATV

Firstly, you need to generate some video signals - most ATV operators will start with a camcorder as the camera in the shack and a media card reader, available for around £10, to generate test cards and station information slides.

For analogue transmission on 23cms and 13cms most stations use the range of Comtech modules which are available for less than £50. These generate around 20 milliwatts but when fed in to a 2 stage power amplifier will provide around 10 watts after filtering.

Digital transmission is more complex and in order to reduce the cost a number of projects have been developed by the ATV community – these range from the low cost DIY approach of the Digilite project ***http://www.g8ajn.tv/dlindex.html*** up to the more complete approach of the DTX1 which is available from the BATC shop and provides a ready built digital transmit system to cover 70cms and 23cms.

Linear power amplifiers from DB6NT ***http://www.kuhne-electronic.de/en/home.html*** and Minikits in Australia ***http://www.minikits.com.au/*** can be used for ATV operation although for digital use, the drive level must be reduced by up to 50% to ensure good linearity. After filtering, the average ATV station will run around 10 – 15 watts in to a low loss feeder.

Operating

Because of the weak nature of ATV signals, a lot of activity is centred on the TV repeaters and the best way to get started is to find your local repeater group. However, ATV operators do also work DX, particularly during lift conditions and distances up to 500 Km are easily achievable. As with all microwave activities, talkback is often the challenge and a new web based tool specifically for ATV DX working has recently been launched at ***www.dxspot.tv***

Most ATV stations operate from home with a modest outside antenna system, particularly if they are in the coverage area of a local repeater. However, the BATC also organises activity days and contests and a lot of operators go out to operate portable stations on the local high spots.

How technical is ATV?

Having said that ATV need not be complex, it is also the one of the few areas of the hobby which still supports active experimentation and developments.

Whilst the BATC and other groups have made entry in to the hobby easy for newcomers, most people find that once they "catch the bug" they are very soon building small projects and soon are experimenting with pre-amps and other pieces of home built video and RF equipment. For others, the big attraction is that there is limited commercial amateur radio equipment available and the hobby can be as technical as you choose with a large element of experimentation at frequencies above 1 GHz and high speed digital transmission techniques.

Areas currently under investigation by the ATV community include the use of SDR technologies, the potential of powerful small computer systems such as Raspberry Pi and ways of generating and transmitting 3D and HD video.

The future?

Two very exciting things are about to happen for the ATV community.

Firstly, the launch of live TV from the ISS - whilst it will be using standard DVB-S equipment in the 13cms amateur band, due to the potentially low power of the signals and the orbit of the ISS, receiving it will be pretty challenging but some ATV ops will be setting up equipment to receive it. For the rest of us, the live pictures from several large ground stations around the world will be available on the BATC streaming portal.

Secondly there are plans in late 2016 to launch a geo-stationary satellite dedicated to Digital Amateur TV – this will enable ATV contacts between amateurs across continents.

ATV – why not?

ATV is very easy to get started in and yet has plenty for everyone – take a look at the BATC forums to see what people are talking about today ***http://www.batc.org.uk/forum/***

To find out more, contact your local repeater group, read the Bi-monthly ATV column in RadCom or join the BATC ***http://www.batc.org.uk/club_stuff/members.html***

As well as being great fun, ATV can really compliment other areas of our hobby. ATV has instant appeal as it is "multi-media" and is a valuable tool to attract young people in to amateur radio

At the very least, go and have a look at the streaming video website at ***www.batc.tv*** – but be careful, you might just catch the bug!

Getting Started with RB-TV

Dave Crump – G8GKQ

Introduction

This article is intended to help newcomers get started with Reduced Bandwidth TV (RB-TV) using some existing equipment together with recent new designs. The suggested approach is a step-by-step one to enable testing and confirmation of progress at each stage. The CQ-TV RB-TV Special provides very good background information and can be downloaded from here: ***http://www.batc.org.uk/cq-tv/***

What is RB-TV?

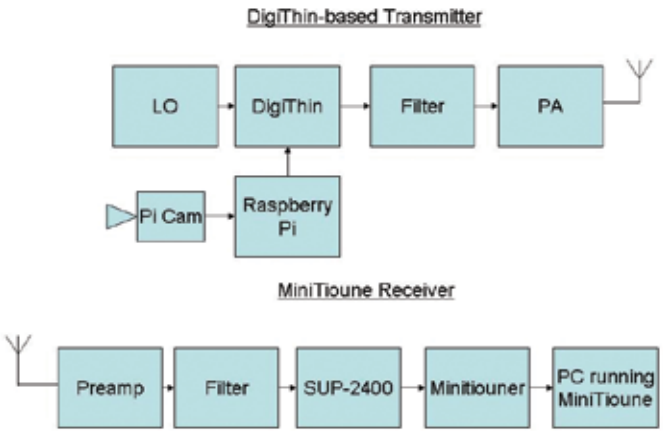
Reduced Bandwidth TV is normal DVB-S fast scan digital TV, but with the following modifications:

- The symbol rate is reduced so that the bandwidth occupied is less than 1 MHz. The BATC suggested standard is a symbol rate of 333KS/s, which occupies a bandwidth of about 450 KHz.
- MPEG-4 coding (rather than MPEG-2) is used for the TV signal as it performs much better within the low symbol rate.

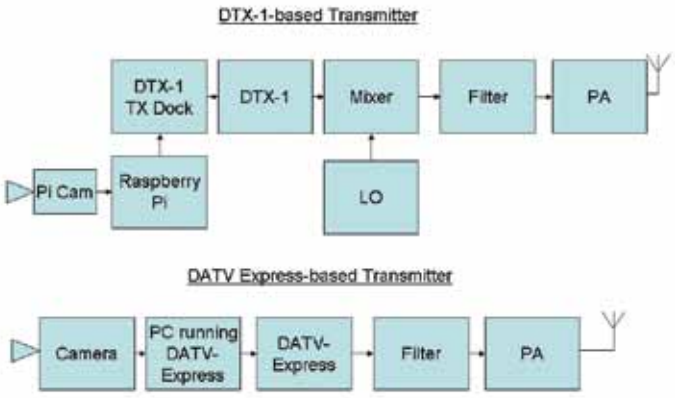
The reduced bandwidth means that the transmissions are compatible with the new (temporary) 146 MHz and 71 MHz bands, and the mode also gives a marked (>6 dB) signal to noise improvement over normal DATV in the higher bands. Sound is not transmitted in this mode – all the available bandwidth is used for vision.

Typical RB-TV Station

A typical RB-TV station is using a Raspberry Pi is illustrated here:



There are 2 other alternative transmitter configurations currently in use:



The entry-level Raspberry Pi station will be described here.

Putting it All Together

To allow a gradual learning curve and testing at each stage, it is recommended that the RB-TV station is put together in the following order:

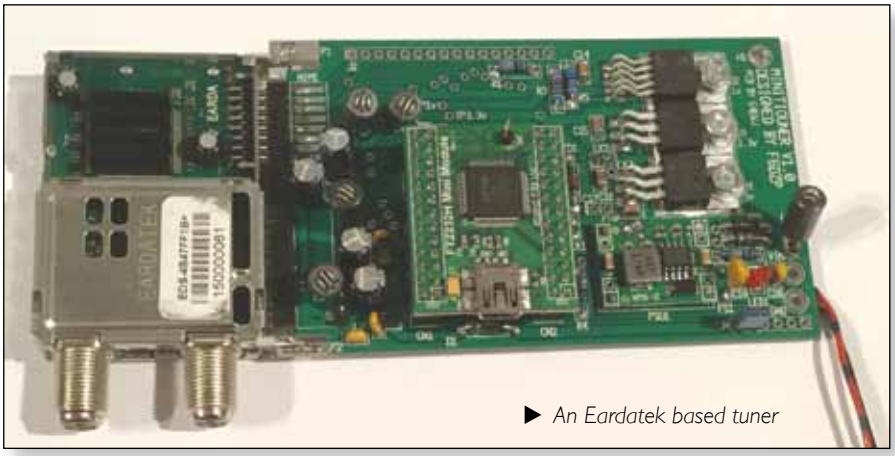
1. Build a MiniTiouner and install MiniTioune software on a PC. Test them with domestic satellite transmissions or an off-air amateur DATV signal. This is the only receiver currently available for RB-TV transmissions.
2. Modify an SUP-2400 up-converter and change the crystal in it to lower the local oscillator frequency. Test, using a standard 70 cms preamp, with a conventional 70 cms DATV station.
3. Get a Raspberry Pi working with a Pi camera. Load F5OEO's software and transmit pictures across the bench to the MiniTiouner using "Ugly DATV" mode.
4. Build a DigiThin plug-in board for the Raspberry Pi. Using a suitable Local Oscillator, transmit pictures across the shack from the DigiThin board to the MiniTiouner.
5. Apply for your NoV to allow you to transmit in the 146 MHz band.
6. Build 146 MHz PAs to raise the power level to achieve 25 W ERP.
7. Tidy up the system with filters and changeover relays.

Each of these steps is described below.

MiniTiouner

Domestic satellite receivers will not decode a DVB-S signal with a symbol rate of less than 1 MS/s, so are not useful for RB-TV. Currently, almost the only reception option is to use a PC with the TuTioune or MiniTioune software by Jean-Pierrre, F6DZP, together with a compatible Digital Satellite receiver card, or an external MiniTiouner kit connected through USB.

The MiniTiouner is the best option and is described in detail on the BATC Forum at ***http://www.batc.org.uk/forum/viewtopic.php?f=15&t=4225***. Printed circuit boards and tuners are available from the BATC shop. There are 2 compatible tuners, the Eardatek (which covers 950 – 2150 MHz) and the Sharp (which covers 650 – 2600 MHz). The latest software can be found on Jean-Pierre's Forum at ***http://www.vivadatv.org/viewforum.php?f=60***. Note that you will need to register to download the software. The software accesses some system functions, and so is reported as malicious by some virus checkers.



▶ *An Eardatek based tuner*

An alternative to the external USB tuner is to use the internal (PCI card) tuners TT S2-1600 or TT S2-3200, although these are no longer available for purchase.

Once your tuner is built, you can verify correct operation by viewing any free-to-air transmission from Sky's Astra satellites. This MiniTioune or TuTioune based receiver is the best decoding solution for DATV transmissions and will also decode the HAM-TV from the ISS.

Up-converter

RB-TV transmissions on 146.5 MHz or 437 MHz are outside the tuning range of Satellite tuners (normally 950 – 2150 MHz, but 650 – 2600 MHz for the Sharp tuners sold by the BATC shop). The transmissions need to be up-converted to within the satellite band.

The SUP-2400 "B-Band Converters" sold by the BATC shop can easily be modified or commanded to up-convert 437 MHz to 1963 MHz. Hardware modifications to permanently enable this are described by Rob, M0DTS at ***http://www.m0dts.co.uk/?tag=DATV&item=90***. Alternatively, the unit can be switched to up-convert using DiSEqC commands as described elsewhere in this issue.

The SUP-2400 can also up-convert 146.5 MHz to 2253.5 MHz, but suffers from poor sensitivity unless the 2400 MHz LO is lowered to below 2300 MHz as described in my article in this CQ-TV.

For best results, you will also need a preamp and a band-pass filter in front of the SUP-2400.

Raspberry Pi and Pi Camera

The Raspberry Pi and Pi Camera enable easy generation of the H264-encoded digital video signal required for RB-TV. Evariste, F5OEO has published some software which enables you to configure the output to start automatically, without the need for a keyboard or a monitor. You may also want to investigate using an HDMI lead to extend the cable on the Pi Camera.

First of all, make sure that your Raspberry Pi and Camera are working properly using the resources at ***https://www.raspberrypi.org/***. Once you have a working camera, download the SD Card image of Evariste's software and put it on a new SD Card. Check the download instructions and initial configuration instructions on the BATC Forum at ***http://www.batc.org.uk/forum/viewforum.php?f=97***.

One of the modes of Evariste's software allows direct generation of a (very dirty) DVB-S signal from the GPIO port on the Raspberry Pi. Enter this mode and then, using your MiniTiouner with a short wire on the RF input loosely coupled to Raspberry Pi GPIO on pin 12, go to 1062.5 MHz and set SR=250K. You should be able to see an RB-TV DVB-S signal. Full details can be found at ***http://f5oeo.fr/UglyDATV01.pdf***.

At this stage, you have proved that your MiniTiouner and Raspberry Pi are both ready for RB-TV.

DigiThin

The signals from a Raspberry Pi in "Ugly DATV" mode are generated directly from square waves and nowhere near clean enough for transmission. Brian, G4EWJ has developed the DigiThin board which will provide about 1 mW of clean DVB-S signal at any frequency between 100 and 1000 MHz (when fed with an appropriate local oscillator). Full details of this board can be found on the

BATC Forum at ***http://www.batc.org.uk/forum/viewforum.php?f=97***.

The PCBs for DigiThin are available from the BATC Shop. There are details on the forum of how to set the Raspberry Pi to program the local oscillator designed along with the DigiThin modulator. Once constructed, you can test your DigiThin by setting it to transmit on 146.5 MHz and receiving it on the MiniTiouner with the SUP-2400 up-converter.

Notice of Variation

Now is probably the time to apply from Notice of Variation (NoV) to authorise you to transmit in the 146 MHz band. You can apply online at the RSGB website: ***http://rsgb.org/main/operating/licensing-novs-visitors/online-nov-application/***. No NoV is required for 437 MHz.

Power Amplifiers

The power limit for 146 MHz is 25 W ERP, so there is no need for massive power amplifiers, but typically 3 W will be required to achieve this ERP, and the DigiThin output is about 1 mw. It is very difficult to achieve much power amplification without distorting the transmitted signal, and even the smallest amount of distortion causes sidebands to appear at unacceptable levels potentially out-of-band.

Rob, M0DTS described 2 power amplifiers in CQ-TV 247 using FET amplifier transistors. These are capable of generating a reasonably clean 1 W, but must be well shielded otherwise the whole system can go unstable. Rob has also described a design using a higher power transistor to achieve 5 W here: ***http://www.m0dts.co.uk/?tag=146MHz&item=148***.

Higher powers (to overcome feeder loss, or for use with low gain aerials) will need larger devices, or the use of pre-distortion – which is technically very difficult.

Filters and Changeover Relays

Filters are essential both in the transmit and receive paths. For transmit, the DigiThin produces reasonable harmonic content, and its close proximity to the Raspberry Pi means that it picks up some of the microcomputer's clock signals. The power amplifiers described above are reasonably broadband, so these signals can easily be amplified and transmitted if filtering is not employed. I use the RSGB VHF-UHF Manual 145 MHz filter described in this issue by Shaun, G8VPG.

On the receive side, tight filtering should be used to try to reject all but the wanted signal, as the Satellite Tuner itself is 27 MHz wide. The fewer unwanted signals it sees within that pass-band, the more sensitive it will be to weak, wanted, signals.

Clearly, you do not need to use changeover relays, and could just plug/unplug between transmit and receive. However, as you are probably going to be using the same aerial for voice talkback, the likelihood of attempting to transmit in the wrong configuration seems high. Best to spend some time fitting changeover relays, rather than repairing preamps at a later date!

Conclusion

Using the building-block approach proposed, an RB-TV station can be built from components that have some commonality with DATV and offer the potential of very long-range contacts, particularly during lift conditions.

A bandpass filter for 146.5 MHz

Shaun O'Sullivan - G8VPG

Having built a Digithin for use on 146.5MHz, I searched around for a bandpass filter to use with it. This is necessary to reduce the level of harmonics and any other mixer products on the output.

I have a large collection of amateur radio books and found the following design in the RSGB "*VHF-UHF Manual*" Fourth Edition 1985. The filter is suitable for low power throughput and I have connected it directly to the output of the Digithin.

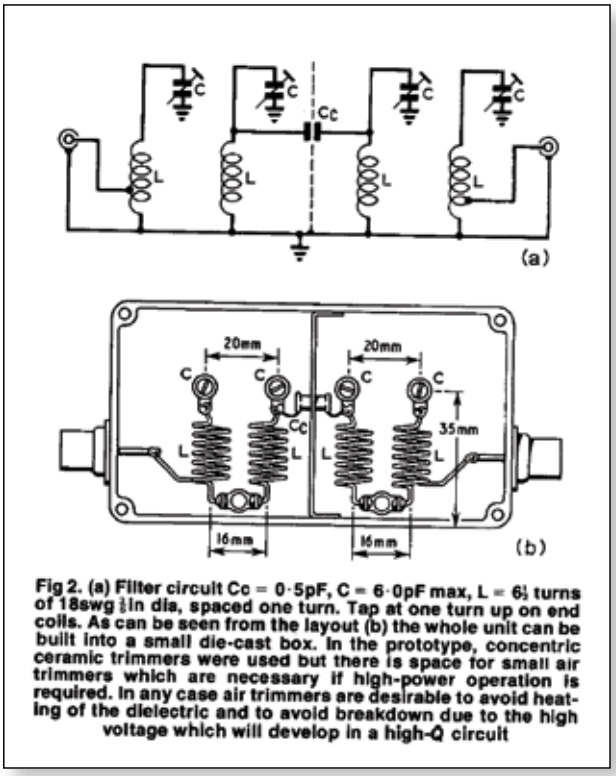
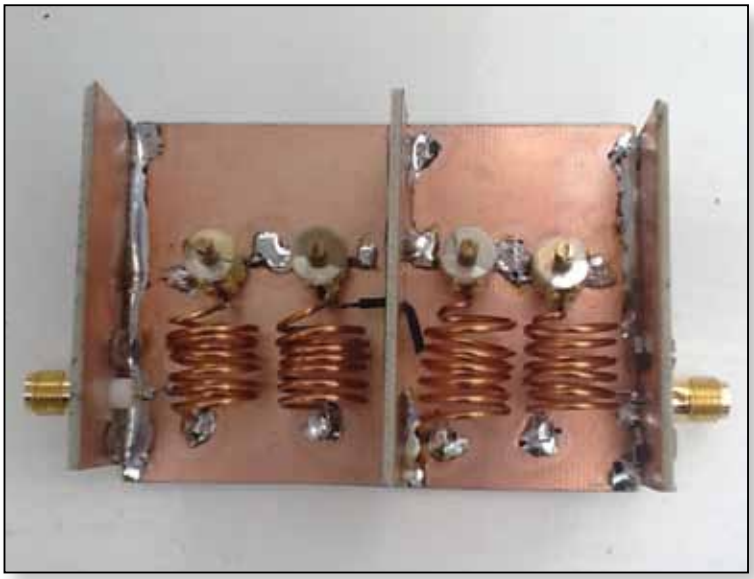


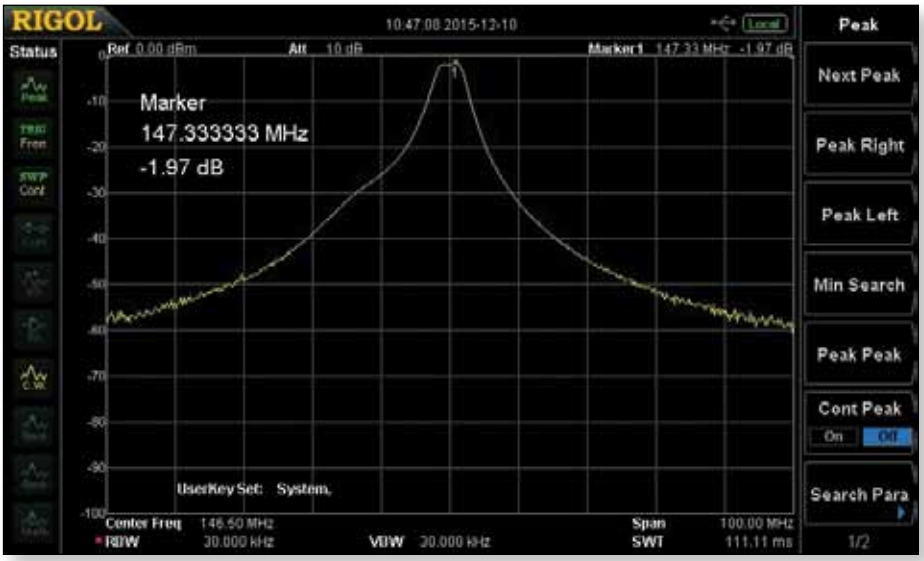
Fig 2. (a) Filter circuit Cc = 0·5pF, C = 6·0pF max, L = 6¼ turns of 18swg ⅛in dia, spaced one turn. Tap at one turn up on end coils. As can be seen from the layout (b) the whole unit can be built into a small die-cast box. In the prototype, concentric ceramic trimmers were used but there is space for small air trimmers which are necessary if high-power operation is required. In any case air trimmers are desirable to avoid heating of the dielectric and to avoid breakdown due to the high voltage which will develop in a high-Q circuit



I drilled a 6mm diameter hole in the screen between the two sections. Finding a 0.5pF capacitor for the coupler between the two sections was not easy, so I used a small piece of insulated solid core wire, soldered to one side. This was passed through the hole and run alongside the second section to provide the correct amount of coupling, which may be adjusted by moving the wire.

The filter can be peaked up for maximum power throughput, but if you have access to a spectrum analyser with tracking generator, it is possible to optimise it and get the passband fairly symmetrical. The insertion loss is 2dB, the –3dB bandwidth 4.5MHz and the bandwidth at –40dB is 40MHz.

I built the filter on some small pieces of single sided copper clad glass fibre board. It is important to solder the whole length of each board junction or else you may get some spurious responses (thanks to Kevin G3AAF who sorted this out for me at CAT15!). The trimmers were bought at a rally and measure 1.7-14pF. The filter peaks up with them partly meshed, so they seem to be about the right size.



DiSEqC control for the SUP2400

Ron Mount – G7DOE

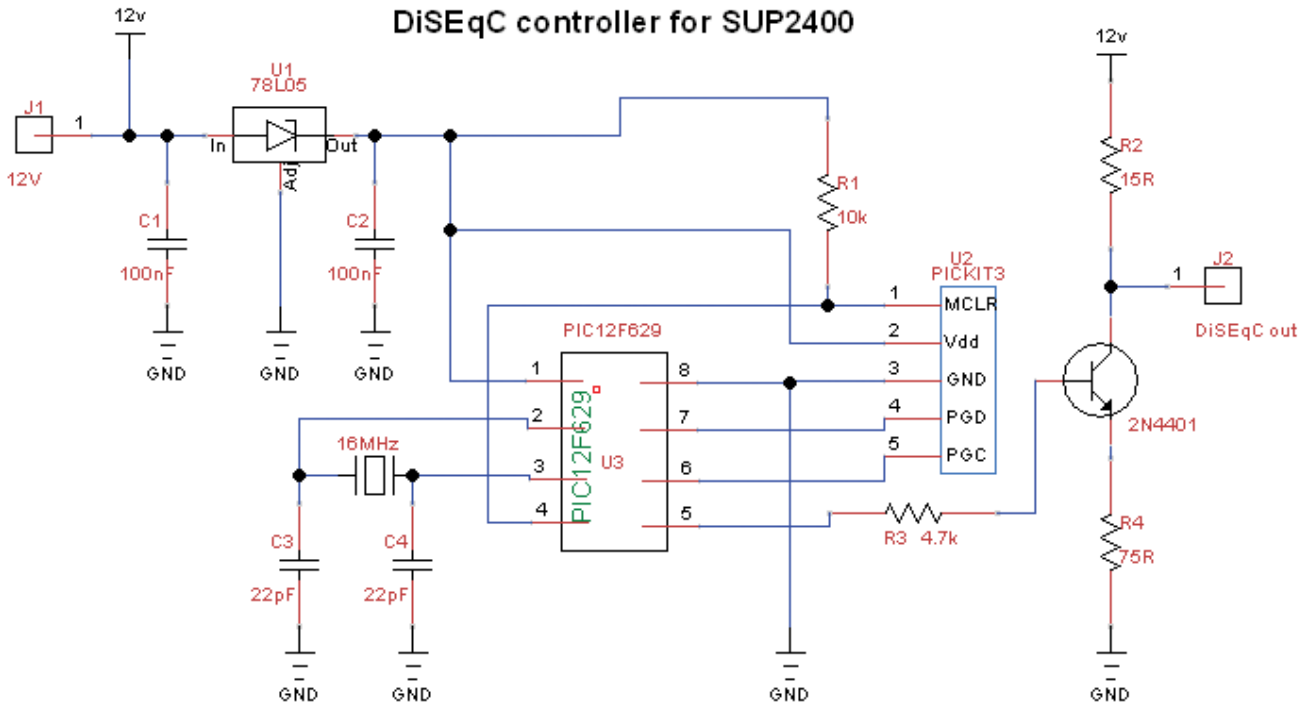
No need to do the hardware mods anymore to the SUP-2400! Ron, G7DOE, presents an alternative using DiSEqC control - Editor

The SUP2400 is the workhorse up-converter for us to bring 70cm TV signals into the range of a set top box. When you power the block up though, it acts in pass-through mode, without up-conversion. M0DTS has identified a set of hardware hacks that force the converter to up-convert but it niggled me that here was a block designed precisely to convert B band up to STB frequencies - it just needs telling to do so, with no hardware hacking. How should it be directed? The answer is using the 22kHz encoding system known as DiSEqC, a well documented scheme tolerant of precise frequency (within ±20%) and of amplitude (0.3v - 1.0v peak to peak). And it's easy enough to generate using a PIC microcontroller.

That's sorted then? Not quite. DiSEqC tells you how to send a command sequence but it can't define the actual commands DirectTV have chosen to control their rather special BBC module and it's quite difficult to find this even on the wondrous internet. It is there though, buried in odd places and the answer is definitely specific to DirectTV. To turn the module into up-convert mode you must send the sequence (in hex): F2 03 00. You might not need the 00, but standard DiSEqC commands occupy 3 bytes, so this is what I have done. The F2 is standard enough, it says there's a command coming and I'd like an acknowledge when you have processed it (which I choose to ignore). The 03 is like the DiSEqC standard 'turn equipment on' command but it's in the wrong byte position, normally it would be 3rd. The corresponding 'turn conversion off' command would be F2 02 00, though I have no interest in testing that.

DiSEqC format

Commands are passed as a nominal 650mV peak to peak, 22kHz modulation on the 12 volt supply to the module. Binary one is represented as 0.5ms of 22kHz followed by 1.0ms of no signal and binary zero is 1.0ms of signal followed by 0.5ms of no signal. The most significant bit is sent first. In my implementation, the 22kHz clock runs steadily in the background, setting and clearing the clock variable at the correct rate and all driven by a standard timer interrupt. A binary one is then 11 cycles of this clock followed by 22 cycles of zero modulation and a binary zero vice versa. All very digital! The software beyond the clock stuff is trivial; on power up, hang around for 100ms for the SUP2400 to wake up properly, then send F2 03 00 and go to sleep, job done.



Without this command sequence, my SUP2400 takes around 50mA and after switching to up-convert mode, this goes up to ~90mA, so something is happening! ☺

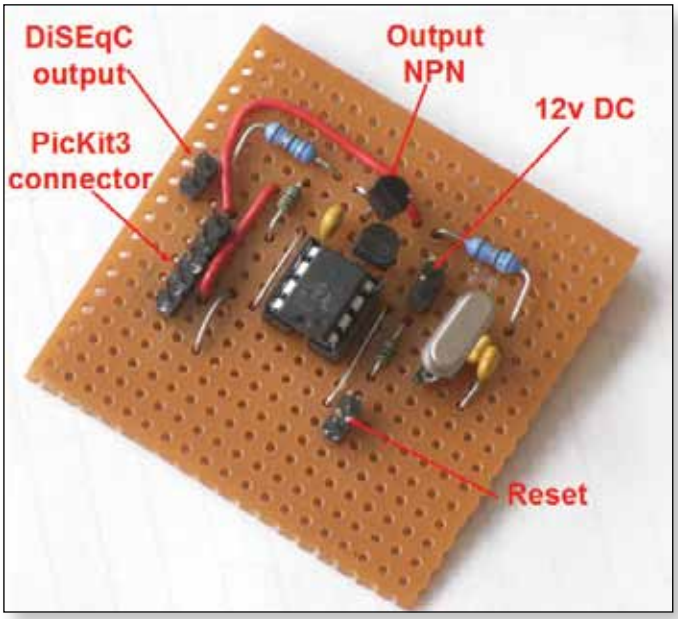
PIC details

It's not a job that demands many I/O pins, so I chose an 8-pin PIC12F629. I program these in C mostly, which slows some things down a bit (but who cares?) so I used an external 16MHz crystal as the PIC clock. These are available for pence on eBay. I'm sure an enthusiast could get close enough to 22kHz using the internal 4MHz clock and so dispense with the crystal and its two capacitors. The circuit is shown in Fig 1. The idea of the 12v driver was nicked off something similar on the internet somewhere and offers the 15Ω source impedance specified for DiSEqC. The modulated 12v supply is passed to the SUP2400 through a home made bias tee. There's an excellent tutorial on the design of bias tees on the Microwaves101 web site. I'm using this kit with a MiniTiouner and you might be able to use the second F connector on the Eardatek module but there is a reported voltage drop using that route which might be too much for the SUP and I don't know if it will carry the 22kHz modulation so you are on your own!

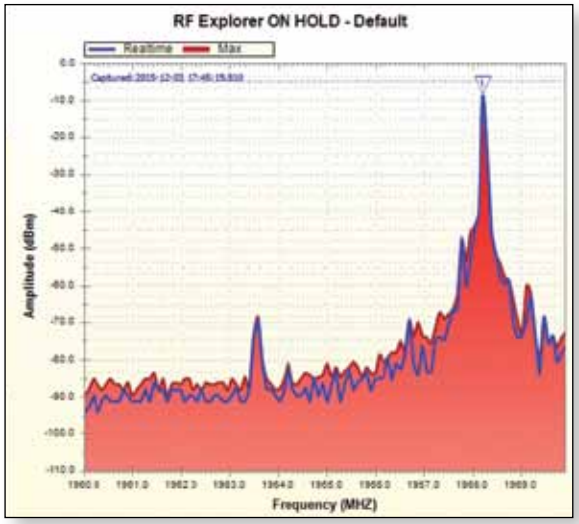
Getting it to work

Build the circuit on a bit of stripboard, nothing is critical, Figure 2. I program the PICs with a PicKit3 using the In-Circuit Serial Programming feature. I can provide the source code and/or the corresponding hex file on request and will upload them to the BATC forum. Figure 3 shows the output at around 1968.5MHz for a 432MHz test input of about -10dbm.

Just need to box these bits up now!



▶ *Figure 2: Stripboard layout*



▶ *Figure 3: Output spectrum near 1968MHz, up-converting from 432MHz.*

BATC at the Rallies.

The BATC will, as usual, be attending a number of rallies throughout 2016. The aim of attending these events is to publicise amateur television to radio amateurs generally and to encourage new memebrs to join the BATC. The stand includes past copies of CQ-TV and other information about ATV and where possible includes a practical demonstration of the mode.

We will be attending the next NORBRECK rally, but obviously it's not possible for one person to cover all the rallies. If you would like to help your club, please offer to cover your local rally. Details from the Secretary: ***secretary@batc.org.uk***

Video Fundamentals - Part5

After the Lens

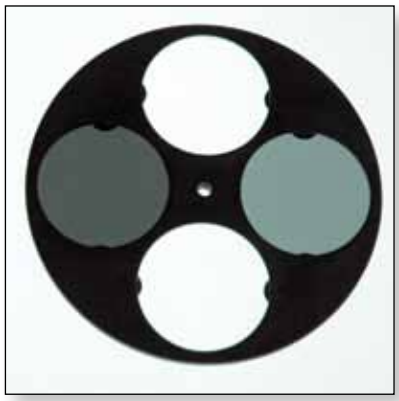
Brian Summers – G8GQS

Last time we looked at the camera lens, this month we will look at the next stage in the process.

Lens mounts: Perhaps a word about how the lens attaches to the camera, a common one is the 'C' mount[1] derived from the film industry and used on many CCTV cameras. It is a screw thread nominally 1 inch in diameter, with 32 threads per inch. There is also the less common 'D' mount of 0.625 inch diameter. In broadcast there have been many different mounts but recently many manufacturers have used the 'B4' mount, but even within this mount there are different image sizes and servo unit connectors.

Filters: Immediately after the lens and in front of the sensor there may be one or more filters.

- Neutral density filters, these are often mounted in a disc which can be rotated to place one in the light path to reduce the light level. A typical choice is, clear, 10%, 1% and a cap position. These are often quoted as the equivalent number of lens 'stops', see last issue of CQ-TV.



▶ *Fig: 1 Filter Wheel*

- A colour correction filter, if the cameras normal white balance is for indoor lighting a minus blue helps a lot with outdoor lighting which has more 'blue' in it than indoors artificial light. Sometimes both Colour and ND filters are mounted in the same disc.
- Especially with older cameras there may be an optical low pass filter.

▶ *Fig: 2 Top row = -Blue, Clear, ND and a dark ND filters Bottom = a different -Blue and a Star filter*

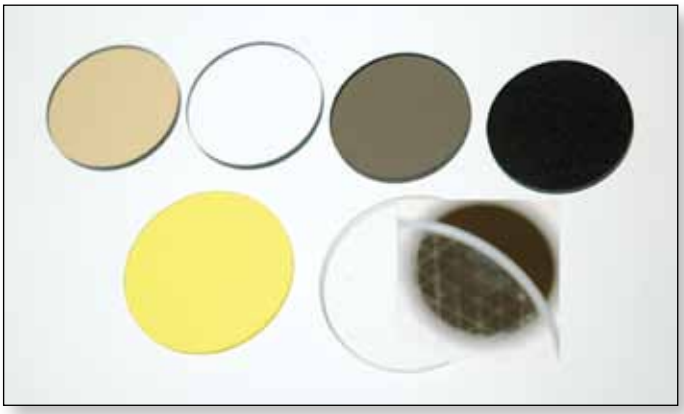


Fig: 1 shows a typical filter wheel with 2 clear filters and $^{1}/_{16}$ ND and $^{1}/_{4}$ ND.

Fig: 2 shows a selection of filters, the different minus blue filters give correction for different camera colour temperatures. ND and colour filters can be mounted on the front of a lens for cameras without a filter wheel.

Special effect filters are often used, this one is a star filter and it is made by lines scribed onto the filter surface. The number of star points being related to the line pattern.

The optical low pass filters or Birefringent Filters, to give them their proper name, are made from several layers of thin sheets of glass Fig: 3. Without going into the details of their construction[2], the need for them is easier to understand if you first consider the electrical low pass filter placed before an A to D converter and the Birefringent filter serves a similar purpose and eliminates the alias effects in the CCDs output. The pixel structure of a CCD x by y pixels forms the equivalent of the sampling frequency of a A to D converter.

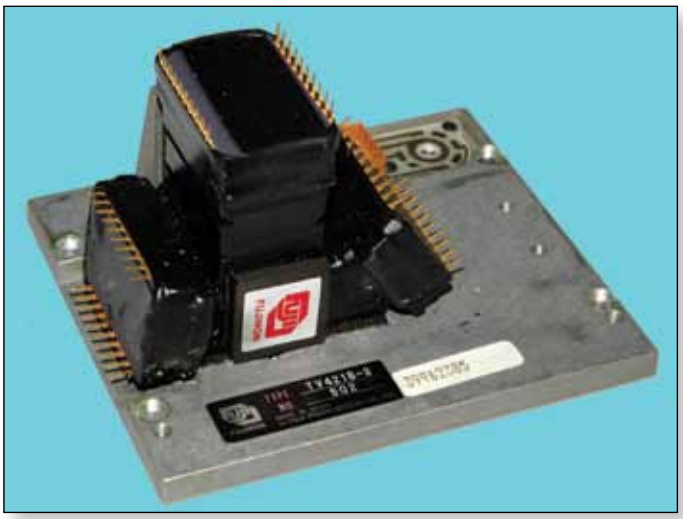
▶ *Fig. 3 Birefringent Filter*

The older analogue tube cameras did not need a Birefringent filter as the tube target itself acted as a low pass filter, but with the pixel structure of CCDs a filter was needed. Newer CCDs & C-Mos sensors have a higher pixel density (equivalent to a higher sampling frequency) so in some instances the birefringent filter is not needed as the lens itself becomes the low pass filter, see MTF[3].

1 Wikipedia.org/wiki/C_mount

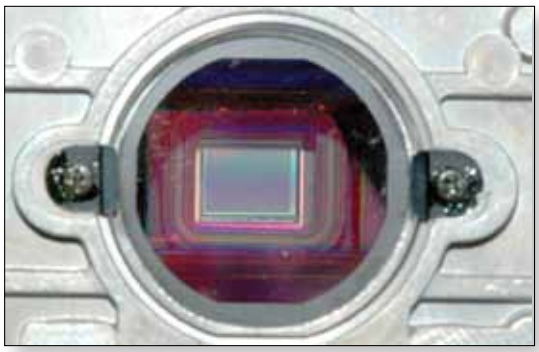
2 Wikipedia.org/wiki/Birefringence
pmoptics.com/files/Birefringent_filter_plates.pdf

3 MTF or modulation transfer function, the optical equivalent of frequency response.



▶ *Fig: 4 A three chip light splitter block*

There is a choice for the next item. The traditional tube colour camera had either a light splitter that separated the light into red, green and blue light and on to the tubes or the other, and cheaper, choice was to use a tube with coloured stripes on the target. Sometimes a two tube combination was used.

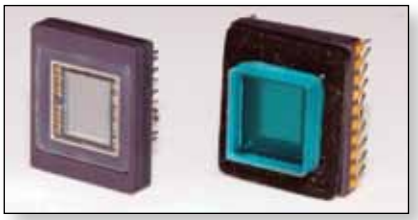


▶ *Fig: 5 the view into the light splitter block showing the image of the 3 CCD's together.*

When CCDs were first used both methods were used, the choice with a light splitter and 3 CCDs giving much superior results. These 3 CCDs were precision glued to the light splitter and a lot of the old tube adjustments disappeared. In Fig: 4, the light splitter block is face down, the lens would be below.

As in the tube case it was possible to 'Stripe' the CCD and this is what was used in domestic and economy cameras.

Of course the march of technology has improved the performance of sold state sensors to give large pixel densities and the descendants of the stripe CCDs are very good. Broadcast cameras still tend to 3 CCDs but there are new single sensor designs (the Red cameras, for instance) that produce excellent results.



▶ *Fig: 6 Two CCD chips, one with the Birefringent filter.*

At this point it is worth stating that CCDs are essentially analogue devices. The spacial resolution is digital in the sense that there are x by y pixels, giving the resolution, but the output signal depends on the number of photons arriving and generating a proportional number of electrons that are accumulated in each pixel site before being clocked out. These electrons are applied to the input of a A to D converter at the earliest point possible, in recent devices on the CCD chip itself.

The CCD[4] was described in CQ-TV 141 to 143 downloadable from The BATC website

4 Wikipedia.org/wiki/Charge-coupled_device

Situation Vacant

There is a wealth of useful knowledge contained in the past issues of CQ-TV and all the back issues are available for members to download.

Some long years ago Ian Pawson, who was the editor of CQ-TV at the time, produced a useful index of the contents of CQ-TV. This was last published as an A5 booklet, and it can be downloaded from this page:- http://www.batc.org.uk/cq-tv/archive/handbooks.html

One of the projects your committee hopes to complete is an update of this index to include the contents of the recent CQ-TV's. The exact format of the new index has not been finalised and it may be published as a "Wiki".

Due to time pressures and the other duties the committee members undertake, it was hoped that a club member might come forward to help with this task.

This could be any member anywhere in our worldwide membership, some software knowledge would be required along with patience to do the sorting and typing needed. It would not be necessary to join the committee in order to create this useful benefit for the members of the BATC.

If you would like to help in running the BATC, or for further information, please contact our chairman Noel Matthews chairperson@batc.org.uk or the Treasurer, Brian Summers treasurer@batc.org.uk

Simple System to Receive ARISS HamTV

Dave Crump – G8GKQ

For some time, I have wanted to receive pictures from the 2395 MHz HamTV transmitter on the International Space Station, but had decided that the equipment was too complex. However, I have now built a simple system that successfully receives brief (20 second) transmissions using a 60 cm fixed dish.

I waited for a pass with high (>60 degrees) elevation and pointed the dish towards the highest point of the ISS pass across the sky. Without moving the dish, it is possible to receive 20 seconds of decoded video.

You can use the free iPhone/iPad app *"GoISSWatch"* to find out when the next pass is and its highest point:

Technical Details

My dish has 60 cm diameter with an F/D of 0.5. I had previously used it for 10 GHz. I mounted it on a photographic tripod. Any similar dish with and F/D of between 0.33 and 0.6 would probably work.

The feed was a helical feed designed by G3RUH. Details are here ***http://www.amsat.org/amsat/articles/g3ruh/116.html***. Note that the feed is left hand circular polarisation which, when reflected in the dish, gives a right hand circular polarisation to match the ISS transmissions. The later "patch" feed designed and sold for use with AO40 might give slightly better results.

I used a preamp mounted directly behind the feed. This was a G3WDG025 design with nominally NF=0.3dB and Gain=17.5dB, although I'm not sure that mine was that good. Details are at ***http://reocities.com/CapeCanaveral/station/7948/preamps.htm***.

The output of the preamp was fed through a short cable to a California Amplifier (Type 31909) MMDS downconverter. This has an LO of 1664 MHz, so gives an output at 731 MHz from the HamTV transmission at 2395 MHz.

I used a 5 MHz-wide 731 MHz band pass filter after the downconverter to filter out very strong local WiFi signals just above 2395 MHz. This was a 4-element filter from my junk box, and may not be necessary for other locations.

I ran a long cable from the dish to the shack and used a domestic 30 dB satellite line amp to raise the signal level before the tuner.

The MiniTiouner kit with the Sharp tuner works well at 731 MHz, and I ran the MiniTioune software (Version 0.3a) on a desktop Windows 7 PC to decode the video. You can see the result here with the blue line on the left hand side that seems to be transmitted by the transmitter on the ISS while it does not have a camera connected.

The Tuner, USB module and PCB for the MiniTiouner are available from the BATC Shop ***https://batc.org.uk/shop/hardware-and-kits***. The MiniTiouner software is available from ***http://www.vivadatv.org/viewtopic.php?f=60&t=441***.

With more gain at 2395 MHz it should be possible to feed the signal from the preamp to the tuner at 2395 MHz, but I had the downconverter available so this provided me with the easiest solution.

Note that the ISS HamTV transmitter is not always active. You can check its status during a pass by looking at ***https://principia.ariss.org/Dashboard/*** and seeing whether it is being received by Goonhilly. I hope that you have as much success as I did. We just need the camera to be connected at the ISS now!

Using FFmpeg to generate a transport stream - More details

Chris Tanner - MW0LLK

Generating a valid transport stream for DATV Express without one of the listed PVR type of capture/encoder cards is well within the capabilities of modern computers so why are we reliant upon hardware encoders?

I first became aware of this hardware encoder approach with the launch of Digilite a few years ago. At that time software encoding in real time was very challenging so using a hardware encoder was a sensible way to go. More recently the availability of suitable encoder cards has become limited as the PVR market has moved on to embrace H264 and other hardware codecs. Cards do come up on popular auction sites however they can be other than advertised (as I found) and are not guaranteed to be in full working order. Further there is limited value investing in a digital television transmission system if you're going to feed it with an analogue signal in the first place!

A solution was sought and experimentation done with tools like VLC, FFmpeg and avconv. In the event I found that FFmpeg provided the best early results so have developed a solution to the point where I can reliably generate a valid transport stream for DVB-S mode using Charles G4GUO DATV Express Server.

VLC appears capable of generating a suitable transport stream however I found it very difficult to locate specific documentation for things like setting PIDs and meta data and also experienced stability problems with it silently crashing mid-stream - not an ideal situation in the middle of a QSO!

I also found that if you're using FFmpeg to generate a transport stream for DATV Express you can very simply add text and simple graphics overlays to the video feed using video filters. This is important for DATV enthusiasts as we are required to give our call sign at intervals and what could be more convenient than a text overlay on screen. Of course if we move to a purely digital format we cannot add the overlay using a conventional overlay processor as the analogue signal is never available. I've tagged on a section at the end of this discussion detailing how to get started doing this.

Anatomy of the FFmpeg command line:

Take my previous article "DATV Express with vMix using FFmpeg to generate the Transport Stream" - this included a batch file to run on the Windows machine which launches FFmpeg to do the video and audio compression and assemble the transport stream.

The last line of the batch file:

```
start "Video feed to DATV Express" /
high c:\ffmpeg\bin\ffmpeg -f dshow -i
video="vMix Video" -f dshow -i audio="vMix
Audio" -f mpeg2video -pix_fmt yuv420p
-r 25 -s 720x576 -aspect 4:3 -qmin
2 -qmax 35 -b:v %VIDRATE%k -minrate
%VIDRATE%k -maxrate %VIDRATE%k -bufsize
%BUFSIZE%k -acodec mp2 -ab 128k -ac 2
-f mpegts -mpegts_original_network_id 1
-mpegts_transport_stream_id 1 -mpegts_
service_id 1 -mpegts_pmt_start_pid
4096 -streamid 0:289 -streamid 1:337
-metadata service_provider="MYCALL"
-metadata service_name="My Station ID" -y
udp://192.168.2.2:1234?pkt_size=1316
```

…looks pretty horrendous doesn't it. Let's break it down a bit!

The first thing to do is to make it more readable by breaking it into separate lines - the ^ character is used as a line continuation in Windows:

```
start "Video feed to DATV Express" /high
c:\ffmpeg\bin\ffmpeg ^
 -f dshow -i video="vMix Video" ^
 -f dshow -i audio="vMix Audio" ^
 -f mpeg2video -pix_fmt yuv420p -r 25 -s
720x576 -aspect 4:3 ^
  -qmin 2 -qmax 35 ^
  -b:v %VIDRATE%k -minrate %VIDRATE%k
-maxrate %VIDRATE%k ^
  -bufsize %BUFSIZE%k ^
 -acodec mp2 -ab 128k -ac 2 ^
 -f mpegts ^
  -mpegts_original_network_id 1 ^
  -mpegts_transport_stream_id 1 ^
  -mpegts_service_id 1 ^
  -mpegts_pmt_start_pid 4096 ^
  -streamid 0:289 ^
  -streamid 1:337 ^
  -metadata service_provider="MYCALL" ^
  -metadata service_name="My Station ID" ^
  -y ^
  udp://192.168.2.2:1234?pkt_size=1316
```

Taking each line in turn:

```
start "Video feed to DATV Express" /high
c:\ffmpeg\bin\ffmpeg
```

This launches FFmpeg. We could simply run it but using the Start command gives the window a title and, more importantly, allows us to set the process priority.

Type `start /?` into a Windows command prompt and it will tell you "Starts a separate window to run a specified program or command."

"Video feed to DATV Express" becomes the window title

`/high` specifies that the program should run at high priority - we need this to ensure FFmpeg keeps the data flowing while Windows runs vMix in the foreground and checks for Windows updates etc. etc. etc. in the background!

You may wish to use a similar trick to launch DATV ExpressServerApp if you're using it. I find that unless both this and FFmpeg are running at high priority my signal breaks up whenever vMix is panning or zooming or otherwise busy - but I am using a relatively old PC!

The rest of the line is the FFmpeg command. In a nutshell it tells FFmpeg to receive two data streams - one video, one audio, how to encode each of those streams, and what wrapper to put them in - the Transport Stream. Depending where you have installed FFmpeg you may need to change this.

```
-f dshow -i video="vMix Video"
```

Tells FFmpeg to receive a video feed in DirectShow format from the DirectShow device called "vMix Video". This could equally be any other DirectShow device such as a webcam or video grabber - don't be afraid to experiment!

```
-f dshow -i audio="vMix Audio"
```

Tells FFmpeg to receive a second feed - audio this time - from the DirectShow input called "vMix Audio". vMix will allow you to tweak the synchronisation between audio and video however I found it to be pretty good without adjustment.

```
  -f mpeg2video -pix_fmt yuv420p -r 25 -s
720x576 -aspect 4:3 ^
  -qmin 2 -qmax 35 ^
  -b:v %VIDRATE%k -minrate %VIDRATE%k
-maxrate %VIDRATE%k ^
  -bufsize %BUFSIZE%k ^
```

This specifies the video encoder to use - mpeg2video and gives various parameters for it: (See table below)

There seems to be little documentation out there on exactly how these parameters should be set but these seem to give reasonable results.

A note on symbol rates and picture resolution

I have found that whilst these values work well at higher symbol rates however at 2,000 ksps used for GB3TM input the frame breaks up somewhat when large movements are made and during pans, zooms etc. It is recommended to reduce the frame resolution to half e.g. 360x576 which gives good picture quality but halves the data throughput requirements.

`-pix_fmt yuv420p`	specifies the pixel format otherwise FFmpeg will use `yuv422p` which won't work (not with the rx at GB3TM anyway)
`-r 25`	`frame rate 25 fps`
`-s 720x576`	`frame size 720 wide by 576 high **see below`
`-aspect 4:3`	`aspect ratio 4:3`
`-qmin`	minimum q (quality) value to use - higher values make the picture more blocky
`-qmax`	maximum q value to use - lower values keep the picture quality up at the expense of possibly running out of bandwidth causing total picture breakdown
`-b:v %VIDRATE%k`	the nominal bitrate for the video stream. %VIDRATE% is substituted in the script for a calculated value depending on symbol rate and forward error correction selected. The trailing k just specifies * 1000 as we calculate it in kbps
`-maxrate %VIDRATE%k`	the maximum bitrate - set the same as nominal to give constant bitrate
`-minrate %VIDRATE%k`	the minimum bitrate - set the same as nominal to give constant bitrate
`-bufsize:v %BUFSIZE%k`	buffer size to use for the encoder. If this is too big FFmpeg uses variable bitrate regardless of the min/maxrate settings so I choose to use 70% of the bitrate value - again calculated in the script.

```
-acodec mp2 -ab 128k -ac 2
```

This specifies the audio codec to use - mp2, the audio bitrate 128kbps and two channels of audio.

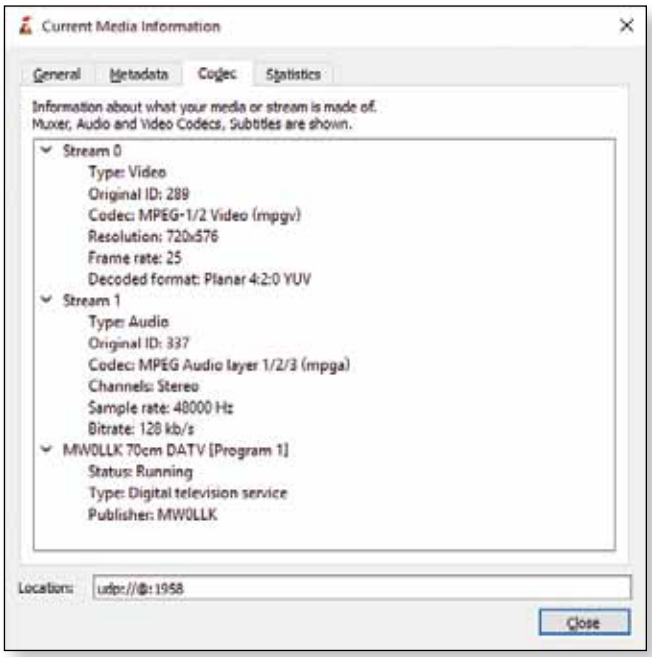
```
-f mpegts ^
 -mpegts_original_network_id 1 ^
 -mpegts_transport_stream_id 1 ^
 -mpegts_service_id 1 ^
 -mpegts_pmt_start_pid 4096 ^
 -streamid 0:289 ^
 -streamid 1:337 ^
 -metadata service_provider="MYCALL" ^
 -metadata service_name="My station ID" ^
```

This is the transport stream wrapper - we could probably get away with just the -f mpegts but the remaining parameters give us complete control over the various IDs and metadata to be carried in the stream.

The first four can be left at the values shown.

The stream ID's for the two streams are important. Different receivers handle these differently - some will pick up the first video and audio streams found regardless of ID, others will remember the ID's used when the channel was set up. With the receiver at GB3TM I have found that matching the video stream ID (0:289) is necessary to ensure the receiver sees the channel (it's been remembered) and matching the audio stream ID reduces the chance of the receiver muting the audio if two stations change over a bit quickly.

The last two parameters add some information about your station to the stream - so called meta-data.



This is good practice as it allows receivers to display your station name and description and provides station identification in machine readable format should Ofcom or others be interested.

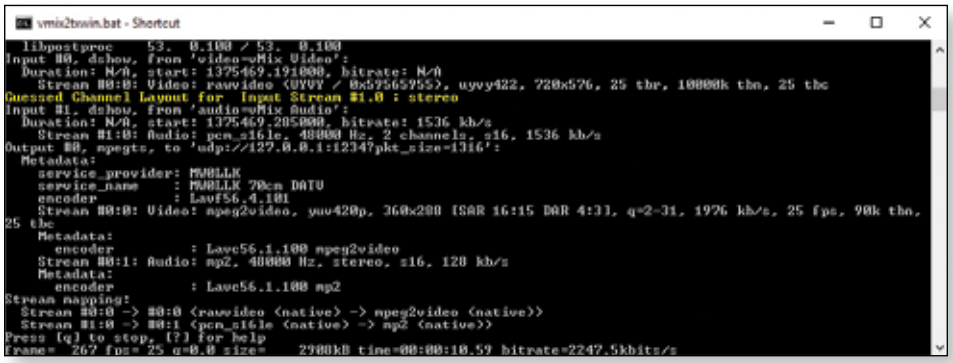
```
-y
```

This just tells FFmpeg that I want to answer yes to any questions it might want to ask me - this is handy in a batch file as otherwise it may hang if running headless.

```
udp://192.168.2.2:1234?pkt_size=1316
```

The last line tells FFmpeg where we want to send the transport stream - in this case across the network via UDP with a specific packet size - which by the way is 7 * 188 but could have been any multiple of 188 up to 255 * 188 from what Charles G4GUO tells me.

You could instead, for example, specify a file name to make a recording of your output.



If you are running the Windows version of DATV Express Server you may wish to keep it all on the one machine - in which case change the last line to:

```
udp://127.0.0.1:1234?pkt_size=1316
```

This specifies the Localhost virtual IP address - which all machines should support - so traffic will be looped back to the same machine.

The :1234 part is the port number to use. This may be any number larger than 1024 (below this is reserved for operating system so called common port allocations) but must match the port number used by the DATV Express software. The Ports referred to here are not physical ports but virtual ports used within TCP/IP to allow multiple applications and services to send data simultaneously across a network link. The port number allows the operating system to determine which application should receive each data packet in much the same way as our stream IDs are used to work out which stream each data packet belongs to.

The upshot of all this is that we now have a really neat solution for mobile DATV use - everything can run on a single Windows based Laptop:

▶ *One Windows laptop to run all your DATV applications - ideal for portable use*

Documentation on these and many other parameters are available in the FFmpeg man pages - type "man FFmpeg" at a linux command prompt or search online for "FFmpeg man".

Text overlays

It's a condition of the amateur licence that you give your call sign at start, end and every 15 minutes during transmission (currently). ATV operators usually have their call sign on display either somewhere adjacent to them in their operating position or as a text overlay added to the video signal.

In your digital ATV station you will probably have a digital video camera, feeding your computer or transmitter via firewire, SDI or HDMI. There is no analogue video available to which a text overlay can be added using a conventional overlay processor or video mixer.

Without an analogue video signal this has to be achieved by other means. Using software like vMix is one solution. This provides a very easy way to composite several layers into one picture including text overlays, graphics and even virtual sets. It is however, frustrating to have to devote an entire input to produce a simple call sign overlay!

FFmpeg allows each of the streams to be processed through one or more "Filters" before encoding and packaging them into the final transport stream. This is achieved through the use of the -vf option.

The filters, with their parameters, are passed to the filter processor in a single quoted string:

```
... -vf "filter1=param1=value1:param2='stri
ngvalue2', filter2=param3=value3" ...
```

- string values need to be enclosed in single quotes: 'stringvalue'
- each parameter is separated by colon characters: :

So how to add a call sign? Here's the line that I use:

```
-vf "drawtext=fontfile='C\:\\Windows\\
Fonts\\verdanab.ttf':text='MW0LLK':x=60:y=
34:fontsize=20:fontcolor=0xffffff7f"
```

Notice that we have to specify the font file to use. This example is for use on a Windows system - on Linux it will

be something like:

```
-vf "drawtext=fontfile='/usr/share/fonts/
truetype/freefont/FreeSans.ttf':text='MW0
LLK':x=60:y=34:fontsize=20:fontcolor=0xff
ffff7f"
```

The key difference being the font path and file name - you can choose whatever font you want although there may be limitations of which I am unaware.

The remaining examples will use the Windows format - mainly because that is the FFmpeg command that I have to hand as I write. All the other parameters used work unchanged on both systems.

The position and size parameters are all in pixels. These will need to be changed to suit the particular screen size and aspect ratio in use. I positioned the text in a little from top and left to allow for overscan on television receivers. It also looks better not crammed into the corner!

The fontcolor parameter will accept colour names e.g. green, white etc. or hexadecimal colour values as either six digit 0xrrggbb or eight digit 0xrrggbbaa where rrggbb specify the rgb values and aa specifies the alpha or transparency.

Values for r, g and b range from 00 to ff where 00 is black and ff is full on.

Alpha values range from 00 (totally transparent) to ff (opaque)

Drop Shadows

To make the text visible even against a similar coloured background I chose to add a drop shadow. Alternatives could include a solid background colour box, or placing the text twice at different sizes and colours with the smaller size on top of the larger so it presents a coloured outline to the small text.

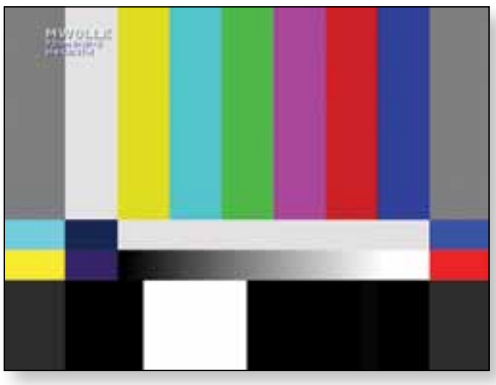
Here's the version with the drop shadow added:

```
-vf "drawtext=fontfile='C\:\\Windows\\
Fonts\\verdanab.ttf':text='MW0LLK':x=60:y=
34:fontsize=20:fontcolor=0xffffff7f:shadow
color=0x003f007f:shadowx=2:shadowy=2"
```

For the drop shadow you need to specify the shadow colour and an x and y offset.

Finally here's the actual filter specification that I currently use when working through our local ATV repeater:

```
-vf "drawtext=fontfile='C\:\\Windows\\
Fonts\\verdanab.ttf':text='MW0LLK':x=60:
y=34:fontsize=20:fontcolor=0xffffff7f:sha
dowcolor=0x003f007f:shadowx=2:shadowy=2,
drawtext=fontfile='C\:\\Windows\\Fonts\\
verdanab.ttf':text='70cm DVB-S':x=60:y=5
2:fontsize=12:fontcolor=0xffffff9f:shad
owcolor=0x00007f9f:shadowx=2:shadowy=2,
drawtext=fontfile='C\:\\Windows\\Fonts\\
verdanab.ttf':text='via GB3TM':x=60:y=65:f
ontsize=12:fontcolor=0xffffff9f:shadowcolo
r=0x00007f9f:shadowx=2:shadowy=2"
```



Where the filters go

The filters are added to the middle of the FFmpeg command after the inputs have been fully specified and before the encoder specifications thus:

```
-i audio="vMix Audio" ^

 -vf "drawtext=fontfile='C\:\\Windows\\
Fonts\\verdanab.ttf':text='MW0LLK':x=80:
y=64:fontsize=20:fontcolor=0xffffff7f:sha
dowcolor=0x003f007f:shadowx=2:shadowy=2,
drawtext=fontfile='C\:\\Windows\\Fonts\\
verdanab.ttf':text='70cm DVB-S':x=80:y=8
2:fontsize=12:fontcolor=0xffffff9f:shad
owcolor=0x00007f9f:shadowx=2:shadowy=2,
drawtext=fontfile='C\:\\Windows\\Fonts\\
verdanab.ttf':text='via GB3TM':x=80:y=95:f
ontsize=12:fontcolor=0xffffff9f:shadowcolo
r=0x00007f9f:shadowx=2:shadowy=2" ^

-f mpeg2video -pix_fmt yuv420p -r 25 -s
720x576 -aspect 4:3 ^
```

Unfortunately I have not found a way to use line continuation characters in filters so these lines do get very long!

While playing with this you will want to view your output without necessarily wishing to transmit it - you can do this with VLC (VideoLAN Client). Point the last line above at 127.0.0.1:1234 as mentioned above and then in VLC open a network stream and specify:

```
udp://@:1234
```

I've found that once VLC is running it sits and waits while I launch and kill FFmpeg as I adjust the various text overlay parameters which is handy.

I have to add a disclaimer - all of the above is based upon much reading of the limited documentation available for FFmpeg and much experimentation. I don't have access to a proper stream analyser or Tutione software so there may well be errors in the stream that I am unaware of! The streams generated with the above commands do work with my satellite receiver and the one on GB3TM so they must be reasonably ok.

I hope this proves useful. I've broken down the FFmpeg command used to generate the Transport Stream for DATV Express and detailed how to add text overlays. Next time I'll adapt this script for use with Adobe Media Server and show how this can be used to transmit using Open Broadcaster - the "Free, open source software for live streaming and recording" - their words - instead of (or as well as) vMix

Links:

Open Broadcaster: ***https://obsproject.com/***

vMix: ***http://www.vmix.com/***

FFmpeg: ***https://www.ffmpeg.org/***

VLC: ***http://www.videolan.org/***

Raspberry Pi: ***https://www.raspberrypi.org/***

Using GStreamer to stream to the BATC server using a Raspberry Pi

One of my frustrations with FFmpeg is that it still doesn't support the hardware h264 encoders implemented on the Raspberry Pi GPU. GStreamer on the other hand has offered support for some time now and it has been added to the distribution with the recent release of Raspbian 'Jessie'.

You'll need a video capture device - I use a cheap UVC dongle (white) available on eBay for around a £5 - it works tolerably well!

I'll cover this in detail in a later article but here's a summary of what's needed:

On a fresh install of Raspbian 'Jessie' install GStreamer tools:

```
sudo apt-get install gstreamer1.0-tools
```

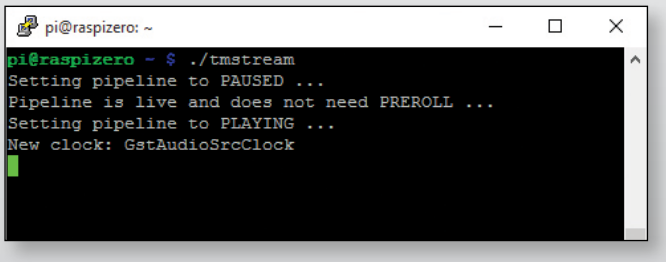
Then copy this into a script file:

```
#!/bin/bash
# Streams UVC video device to batc.tv
gst-launch-1.0 v4l2src  ! "video/x-raw,w
idth=640,height=480,framerate=15/1" ! \
omxh264enc target-bitrate=1000000
control-rate=variable ! \
video/x-h264,profile=high ! h264parse ! \
taginject tags="title=My Stream" ! queue
! \
flvmux name=mux streamable=true alsasrc
device=hw:1 ! audioresample ! audio/x-
raw,rate=48000 ! \
queue ! voaacenc bitrate=32000 !
aacparse ! queue ! mux. mux. ! \
rtmpsink location="rtmp://fms.batc.tv/
live/<streamid>/<streamid>"
```

Note that the last line is like the FMS URL given on your BATC stream management page but with your stream name added a second time to the end of the line.

If you use a different dongle you may need to change the resolution specified in the first line to suit the device capabilities.

Set to executable and then launch it. You should see something like this:



You may need to set permissions for /dev/video0 or run as root.

Good luck - you can see this in action on my members stream - I have it running on a Pi model B version 1, and on a PiZero. I'm usually on air on Tuesday evenings at 7pm and the stream may well be running at other times.

We'll be looking at the use of external video sources with the Raspberry Pi in the next issue of CQ-TV - ED

DATV transmission in the UK – a short history

The 250th edition of CQ-TV is a chance to take a look back at significant changes in our hobby and perhaps one of the biggest changes has been the introduction of DATV.

The world started to change in 1994 with the introduction of the first commercial MPEG-2 encoder and DVB-S and DVB-T modulator systems. Compared to the BATC DTX1, these were huge pieces equipment with a single channel system taking up 22 rack units to only produce a 70 MHz IF signal.

▶ *Equipment required to produce one MPEG2 channel*

They had a price tag to match the size, costing approximately £75k per channel; however the commercial benefits were enormous with satellite broadcasters being able to transmit 4 or 5 channels in the same bandwidth as 1 analogue channel.

The early tests

Towards the end of the 1990s, digital transmission technology has become common place in the TV broadcast industry (Sky's digital satellite and ITV's ondigital service had both launched) and amateurs were starting to experiment with various standards including DVB in the UK and GMSK in Germany.

▶ *First Generation MPEG2 equipment at GB3AT*

During 2000 Noel Matthews (G8GTZ), who worked for a professional Digital TV equipment manufacturer, had access to some redundant equipment and started experimenting with using DVB-S and DVB-T on 23cms and 13cms.

GB3AT at Winchester was equipped with a switchable output between FM, QPSK and OFDM and what was believed to be the first DATV transmission in the UK took place on 9th May 2001 and was received by Roy G8CKN.

▶ *GB3AT digital received by G8CKN*

In 2002 Dave G8GKQ upgraded his 70cms ATV station to be able to transmit 2 MHz QPSK and a number of tests were made with G8GTZ and G8ADM over 60 Km to prove the potential of using DATV on 70cms – see CQ-TV 200 page 23.

▶ *70cms DATV from G8GKQ received at G8GTZ*

▶ *Digital equipment installed at GB3HV*

QPSK vs OFDM

Those experiments quickly showed that DVB-S QPSK had significant advantages for amateur use over the DVB-T 8 MHz OFDM system used for the UK terrestrial broadcast services. In particular, OFDM is very critical on phase noise in the transmitter and requires very, very linear PAs (10 dB + back off compared to analogue). Also the fixed 8 MHz bandwidth had a very poor power / bandwidth ratio compared to the variable bandwidth QPSK system which could be used down to 1.5 MHz and was more compatible with the typical FM power brick in use by many amateurs.

Surprisingly, the QPSK proved to be robust over the typical DATV point to point path with no serious impact from multi-path – this was the major selling point of OFDM over QPSK in the broadcast market.

The one advantage of OFDM is its use for mobile transmissions and was proven by a demonstration at the BATC convention at Bletchly Park in 2001 of mobile DATV using OFDM on 2.3 GHz which proved the robustness of OFDM. This is something we still cannot do using QPSK today (see results from the Maritime mobile tests on the Solent tests in CQ-TV245) and is the reason why today all wireless broadcast cameras use OFDM based technologies.

Repeater tests

In 2003, first generation professional MPEG video encoders and QPSK modulators started to appear on the surplus market and also the German and Dutch DATV project modules became available. This meant that amateurs were now able to generate standard DVB QPSK signals and several ATV operators started to experiment with mixed results. As a result of these experiments, it was decided to fit an NDS System 3000 professional QPSK satellite receiver at the GB3HV site to receive these signals.

Having established the viability of digital transmission on 23cms, at the end of 2003 a user selectable digital transmit capability was added at GB3HV on the main transmit frequency of 1308MHz enabling the first digital in / digital out QSOs on a UK repeater. By purchasing a digital free to air satellite receiver, available for less than £40, and an RF splitter, users who have normally got P2 analogue pictures could now see P5 pictures from GB3HV.

It also enabled detailed comparisons between FM and QPSK outputs during which the now infamous comparison pictures seen in many articles and websites were taken by G8GTZ.

Also at this time, Ian Bennet (G6TVJ) started experimenting with QPSK on GB3ZZ using commercial equipment and achieved surprisingly good results. (CQ-TV 200) and in 2004, the Worthing repeater group's GB3RV on 10 GHz became the first digital only output repeater.

▶ *QPSK experiments at GB3ZZ in 2002*

Digital take up

At the 2004 BATC convention G8GTZ and G8GKQ presented the results from these early tests which clearly showed the advantages of QPSK over OFDM for DATV operators and proposed a band plan using 2 Msymbols QPSK on 70cms and 4 Msymbols QPSK on 23cms.

▶ *Proposed DATV band plan at 2004 BATC convention*

▶ *BATC DTX1 encoder, QPSK modulator and up converter*

Once the technology decisions were made and the DATV standards adopted, the search for practical DATV equipment began. Equipment from SR systems and the AGAF were a more practical alternative for the average ATV shack rather than the large and noisy ex-commericial equipment which was more suited to repeater sites.

Whilst this equipment was more suited to amateur operation, there was still a need for equipment which by using DIY techniques and a little experimentation, the average amateur could get on air with DATV at relatively low cost. A project which started life in France as the Poorman's DATV system was gradually developed by the ATV community in to the tremendously successful Digilite project which sold over 200 units and made DATV a possibility for a lot of ATV operators.

The BATC launched the DTX 1 unit in 2014 as a very compact encoder, QPSK modulator and up converter unit aimed at ATV operators who wanted compact complete solution which required very little constructional effort to get on air. The units were sold at cost to BATC members and to date over 100 units have been purchased by members around the world.

Also in 2014, the SDR hardware based DATV Express project provided a more flexible alternative DATV platform with a wide range of symbols and operating frequency range.

RB-TV

DATV in the UK entered a new phase when in 2014, Ofcom granted the use of an additional 1 MHz at 146 MHz. In order to meet the narrowband requirements, we have adopted new operating practices which are still based around the variable bandwidth of DVB-S QPSK

and a whole new range of equipment has been developed by the ATV community including the excellent DATV receive Tutioune software developed by F6DZP.

Pipo SBC receive system developed by F6DZP

Summary

DATV is in widespread in the UK with many Digilite, DTX1 and DATV Express units and ex-commercial systems in use by ATV operators. Most ATV repeaters have digital inputs and / or outputs. Great credit should be given to the early experimenters and the developers of projects such as Digilite who made DATV transmissions affordable to the average ATV operator.

Whilst this article is about the rise of DATV, it should be noted that BATC policy is to support and encourage all form of ATV including analogue and we work closely with the RSGB ETCC committee to ensure that analogue FM inputs are still provided as an input option for all ATV repeater applications.

As early adopters of DATV, the BATC selected variable bandwidth QPSK as the preferred standard. It was technically superior to 8 MHz OFDM for amateur use. Recent developments, particularly by HiDES, means that narrower bandwidth OFDM is now available and experiments continue with both modes. It is perhaps rather ironic that amateurs in the USA seem to be adopting OFDM technology rather than QPSK – the opposite of the situation 15 years ago, when the US broadcasters decided against OFDM and instead went for 8VSB, which has since been confirmed as a inferior technology for terrestrial broadcasting.

Hopefully this short article has captured the main highlights of this significant change in our hobby – it may not have covered everything, and we would love to hear from you with feedback…

Situation Vacant

Membership Secretary.

Duties:-

- To oversee the recruitment and enrolment of new members.
- Sending out renewal reminders (postal and email) and dealing with the returns. Posting out first magazine for new paper members.
- Logging subscriptions received and paying the cheques into the HSBC.
- Dealing with enquiries relating to membership.

Skills:-

- Modest use of own computer, logging on and entering and amending data into club records. (this is all is menu driven)
- Tactful resolution of members queries and correcting errors in database and deleting old records.

Notes:-

- A large proportion of the membership deal with their own renewals via the clubs website and no action is normally needed from the membership secretary.
- Ideally the new membership secretary is a member of some years standing and would agree to be co-opted to committee to have the additional permissions needed to access the database, but if any member wanted to do the job but not join the committee this would be considered.
- The New membership secretary needs to be UK based because of the postal requirements.
- Expenses, postage, stationary, etc. refunded.
- Help and advice will be given from the other committee members.

Time commitment:-

- Possibly 1 to 3 hours a week, with more at times of peak renewals. Plus committee email discussions.
- Formal committee meetings are conducted by Skype and last about 1-2 hours several times a year. Ideally attendance at the club General Meeting, every other year.

If you would like to help in running the BATC, or for further information, please contact our chairman Noel Matthews chairperson@batc.org.uk or the Treasurer, Brian Summers treasurer@batc.org.uk

Using the Linx 1010b tablet for a portable DATV station

Ian Parker - G8XZD

Like many I got quite excited at the idea of the Pipo X8 which Jean-Pierre F6DZP, discovered worked rather well as a display for his Minitioune project.

I had been looking for a Windows tablet to go with my portable set up to save having to lug a laptop around with me.

In an idea world it would run Minitioune, VMix, FFmpeg, and G4GUO's DATV Express software. I looked at the Pipo but a couple of things put me off - importing it from China or Hong Kong - and facing punitive import, VAT and courier-handling fees - and what to do if it went wrong. You couldn't easily take it back during your lunch hour.

Also as an elderly G8, and getting ever closer to the front of the callbook, the icons and screen seemed very small when I saw one in the flesh at the Flight Refuelling rally.

Anyway fast forward to Black Friday and I managed to pick up a Linx 1010B Windows 10 tablet for just under the £100 mark. They've gone up a bit now (£140) though they do pop up on eBay or Amazon on the right side of £100.

What twisted my arm was that the tablet had two proper-sized USB connectors and many of the reviews were favourable. Anyway it seemed worth a punt.

Having got it home and charged it up I installed Minitioune 0.3a following Jean-Pierre's instructions. It worked first time and even the button sizes seemed fine. Minitioune alone would have secured the deal but being curious I wondered if it would run VMix?

Again I installed it and it worked like a dream hardly taxing the quad-core Intel Atom Z3735F processor.

Next step FFMpeg. This was a slightly more tricky install as it was zipped up using 7Zip, which the 1010B didn't recognise. Using my main PC and a USB stick I managed to copy the files across.

Finally I installed Charles, G4GUO's excellent Windows DATV Express Server. Despite being described as an "alpha release" and "likely to be full of bugs" it works fine with Chris's (MW0LLK) batch file - for generating a transport stream - documented on his website

http://www.tannet.org.uk/

So there you have it an all-in-one tablet for portable DATV. As a bonus the included Edge browser works fine with the BATC streaming site. Even at £140 you still seem to be getting a lot for your money - and as a complete aside it also works well with the DVmini dongle for those interested in DMR.

▶ *Checking DATV Expresser Server on a Satlink WS6906*

Turning Back the Pages

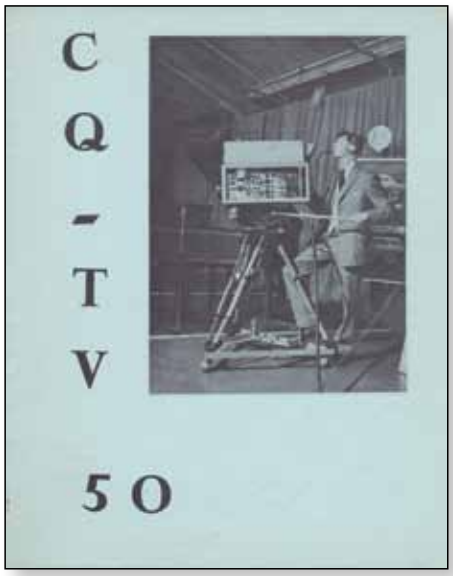
A dip into the archives of CQ-TV, looking at the landmark editions. *Peter Delaney - G8KZG*

CQ-TV has reached 250!

As a change from the usual look back at a particular issue, to celebrate CQTV reaching issue 250, this time "Turning Back the Pages" features issues 50, 100, 150 and 200.

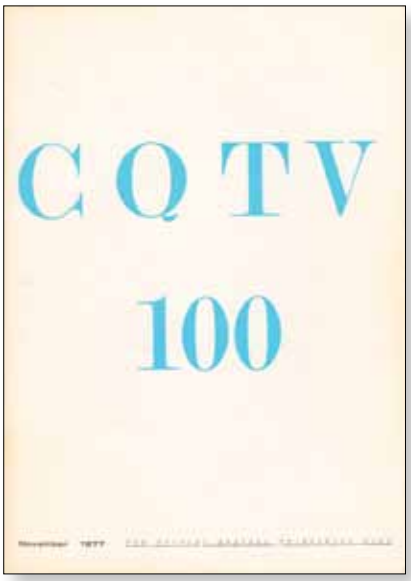
▶ *Issue number 1 - produced on a Gestetner duplicator*

CQTV 50, published in 1963, was of the old smaller format, and contained 28 pages, including the cover (which was of paper, rather than card). The then BATC President, Boris Townsend, wrote "*The half century! Fifty issues of CQ-TV. What a fine achievement this is. I wonder if that little band of stalwarts who founded the club in 1949 (was it really in the bar on Victoria Station) anticipated that their progeny would grow to its present stature? At that time the transmission of television in the amateur bands was not permitted, but in April of the following year, Ivan Howard, G2DUS/T gave the first public demonstration of amateur TV in the United Kingdom at Shefford, and a year later, after vigorous lobbying by the BATC represented by the RSGB the PMG (Postmaster General - then responsible for licencing) finally agreed to the TV licence Now some 70 stations hold licences for amateur television transmissions, and the BATC can set up networks which rival those of professional broadcasters.*" Boris went on to ask "*And what of the future? I expect it to be even more exciting. I believe that we are now in the most interesting era that television has been since the first amateur produced his flickering pictures in that attic in Frith Street in 1928. Roll on the next 50 issues of CQ-TV.*"

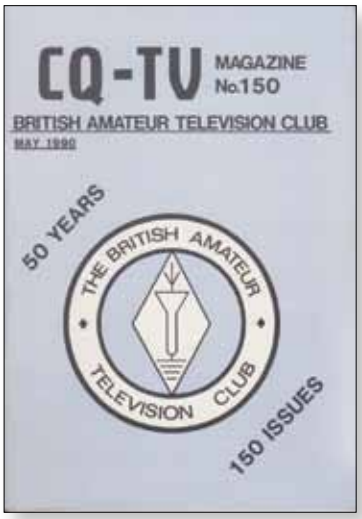


The first CQTV had been published in 1949, and circulated to 12 members. By issue 50, John Tanner was having 1000 printed. He had been the editor for 6 years, although issue 50 was to be his last. The cover illustration showed his 3" image orthicon camera at a demonstration in March of 1963.

By issue 100, in 1977, the magazine had increased to 40 pages, now to A5 size, and contained inside a card cover, which clearly noted this landmark in its publication. The Club's founder, Mike Barlow, (who had edited early editions of the magazine) had written "'*Happy 100, BATC - and may you make it 200!*" Sadly, Mike was to pass away about the time of issue 150.



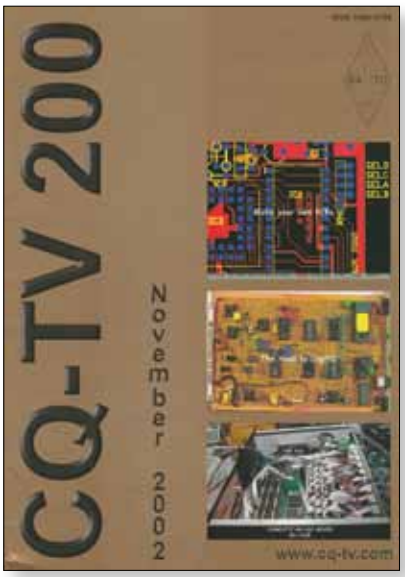
The major article was the first part of "Project 100" written by Eric Putt and Tom Mitchell - a PAL sync pulse generator and matching colour pattern generator. Designed using the 7400 series of TTL logic integrated circuits, the sync pulse generator would produce a full set of drive pulses for interlaced 625 line PAL working, whilst the colour pattern circuit would provide grey scale, grille with castellations, plain red, and colour bars. In development at the time was also a full genlock, and circuits followed for a subcarrier to line lock with the appropriate offsets. The project marked a new innovation for the Club - printed circuit boards would be made available so that members could build a relatively complex design - and many did. The editor of the time, Andy Hughes, was another of those to serve for a long time, before he handed over to John Wood, who also held the editorial pen for many years.



BATC continued to thrive, with more and more articles being written, so the page count for issue 150 in 1990 had risen to 88 - plus the card covers again. John Wood's assistant editor, Mike Wooding, had taken over The variety of club published circuits - both in CQ-TV and also the various 'BATC Handbooks' - had led to the range of printed circuit boards offered by the Club numbering over 50 - covering applications from basic switchers, to a full colour test card generator (on 3 pcbs), and at frequencies from baseband video to microwaves. The wide range of articles in this issue covered topics such as slow scan television, PAL colour theory, television camera tubes, logic circuits and a television gateway on 10GHz (initially working in 'beacon mode'. The cover simply had the Club badge and recognition of the number of issues and age of the Club.

During Ian Pawson's editorship a decision was made to move to the standard A4 format, on a better grade of paper, allowing the introduction of colour to the magazine, as well as larger size diagrams, the first of the new style being CQTV 189 in February 1999. By the time of another centennial issue, with a special gold cover, the magazine had 52 pages within the covers (and being larger pages, that was more 'content' than the 88 pages of issue 150). One change made with issue 200 was to move members adverts from the magazine to the Club website, whilst another was to arrange for the printers to print and pack the envelopes and then despatch via Royal Mail to members. Digital television (as in studios, rather than as a transmission mode - an article on that was on tests at GB3ZZ) was the subject of a series by Mike Cox at this time, whilst Dicky Howett had written several articles about aspects of broadcast television as it 'used to be' - in this issue several former theatres that were used as TV studios in Manchester, Birmingham and London, for both the BBC and ITV companies. The range of other articles included making 23cm filters, making printed circuit boards, and an historical reflection on Philo T Farnsworth - a 'somewhat forgotten' television pioneer, credited with the process of sequential scanning.

I wonder if Boris Townsend, when he wrote about that "that little band of stalwarts" realised that even those first 50 issues would be a small - but vital - part of the Club's development? But, as he said, "Roll on the next 50 issues of CQ-TV."



(The editors mentioned above are not the only ones the magazine has had - Trevor Brown and Chris Smith both served the Club in that capacity, for example, but not, as it happened, for the milestone issues !)

GB3HV

The Home Counties ATV Group had their Christmas Dinner on 8th December, we had 14 places, including wives, at a nice pub near the club site at Binfield. Now we need to get regular activity on GB3HV to reflect this interest.

GB3HV receives on 70cms DATV, 23cms ATV and DATV and 3cms ATV. Transmitter output is on 3408 MHz using DVB-S 2 Msymbols 2/3 FEC and the output is also streamed on batc.tv.

Members get together and have a natter and exchange pictures on Tuesday evening from 8pm onwards

The British Amateur Television Club

The club provides the following for its members:

- A **colour magazine**, CQ-TV, produced for members in paper or .pdf (cyber membership) formats.
- **Web site** – where you can find our online shop stocking hard to get components, software downloads for published projects and much more.

- A **members forum** at www.batc.org.uk/forum/ for help, information and the interchange of ideas.
- A **video streaming** facility at www.batc.tv which enables repeaters and individual members to be seen worldwide.

- An **annual Convention** held in the UK where you can meet other members, visit demonstrations and listen to lectures.
- **Meet other club members** at the BATC stand at local rallies across the country.

www.batc.org.uk

BATC

Out and About

You will be able to see the BATC stand at the following forthcoming rallies and events in 2016. Come and say hello!

10 April – NORBRECK, Blackpool. *www.narsa.org.uk*
17 April – West London Radio & Electronics Show, Kempton Park, Surrey *www.radiofairs.co.uk*

TBC May – Dunstable Downs Radio Club Bootsale. *www.ddrcbootsale.org*
TBC May – Norden, Rochdale *www.radars.me.uk*
4, 5 June – SERF - Eastbourne, Sussex *http://serf.org.uk*
19 June – 29th Newbury Radio Rally *www.nadars.org.uk*
26 June – West of England Radio Rally *www.westrally.org.uk*
17 July – McMichael Rally, Near Reading. *www.McMichaelRally.org.uk*
TBC September – BATC Convention. *www.batc.org.uk*
30 Sept. & 1 Oct – National Hamfest, Lincoln. *www.nationalhamfest.org.uk*
6 November – West London Radio & Electronics Show, Kempton Park, Surrey. *www.radiofairs.co.uk*

More volunteers are needed to run the BATC stand at rallies, especially in the North and West. If you are able to help, please contact the membership secretary.